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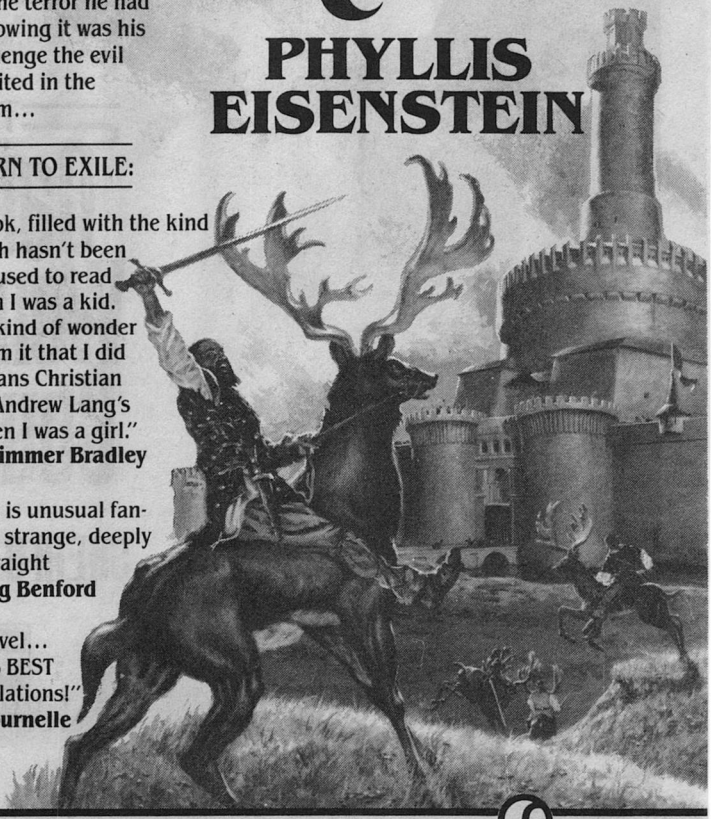

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Editorial

JOB QUALIFICATIONS

Stanley Schmidt

Suppose that for three days you've been running a 103° fever, your throat is dry, you've lost your appetite, and you have a peculiar rash around your neck. Even if you're the type who avoids doctors except as a last resort, chances are that by this time you'd be ready to seek some help. Would you go to *(a)* a doctor with well-known educational credentials and a good reputation among patients and colleagues, or *(b)* a randomly selected person on the street?

I'm reasonably confident that if you have the slightest interest in self-preservation, you chose *(a)*—and didn't even have to think very hard about it. To most people, I suspect, it seems too obvious for discussion that a person hired to give medical treatment should know something about medicine. For similar reasons, you probably expect your mechanic to know something about cars and your plumber to know something about plumbing. If you're hiring a band to play for your daughter's wedding, you'd probably prefer that its members know how to play appropriate instruments and music.

In short, it probably seems self-evident as a general principle that people hired to do any job should know something about that job. Obvious, right? So what?

Now let's turn to something that at first glance may seem unrelated, but isn't. One of the great traditions of this country, we are often told, is government of the people, by the people, for the people. Assuming for the sake of argument that what we have aproximates that ideal reasonably well, how well do the people who are governing themselves know their job?

We've all heard plenty of discussions about the importance of voting and being an informed citizen. There's rea-

son to doubt, though, that most Americans understand the workings of their own government very well, civics and American history courses notwithstanding. But there's even more to it than that. Government is not something that exists in isolation from everything else. The processes of legislation, administration, and adjudication are *about* things—things like energy, pollution, food production, transportation, population, and communication.

How much do the voters—and the people they elect—know about those things?

Precious little, by many indications. Consider, for example, a pair of studies conducted by the Public Opinion Laboratory at Northern Illinois University, sampling people's knowledge of basic—and I mean *basic*—science. One study in 1985 indicated, according to Laboratory director Jon Miller as quoted in a recent Associated Press story, that only some 5% of adult Americans could be considered "scientifically literate." That means having a basic knowledge of scientific vocabulary, methods, and significance. I don't have a corresponding figure for the 1988 poll, conducted for the National Science Foundation, but I do have some figures on specific questions from it. Fifty-five percent of adult Americans did not know that the Earth revolves around the Sun once a year. Some of those had no idea, while others had *wrong* ideas such as the Sun orbiting the Earth or the orbital period being a day. Only 36% knew that a laser doesn't focus sound waves; 29% thought it did, 35% had no idea.

And so on. Science isn't the only problem area, either. You probably heard about the similar studies that were done on *geographic* knowledge. Would a Texan want decisions about Texas made by people who think it's in New Jersey, or that New Mexico is a foreign country?

Many of us were not qualitatively surprised by the results of these studies, but even if we knew ignorance was rampant, we were likely to be startled to learn just *how* rampant. Does it matter? You bet it does. A few paragraphs back, you probably also agreed willingly that you would only want to hire qualified people to do important jobs. You probably agreed that government is an important job, and that it's good for it to be in the hands of the people.

But if the people don't understand how government works, or the issues it must deal with, then you must also agree that government in the hands of such people is an important job being done by unqualified people. If you believe the first two statements, you cannot believe this is an acceptable state of affairs.

But what's to be done about it? As 1988 Nobel Laureate Leon Lederman summed it up, "How can you preserve democracy when the world is increasingly more complex scientifically and technologically and people are increasingly more ignorant of the issues?"

Maybe you can't, in its present form—and maybe that's not as terrible as it sounds to those whose reflexes have been conditioned the way ours have. Maybe it's time to develop something better.

No doubt such talk is already pro-

voking howls of outrage. Even among *Analog* readers I expect to find a few who think present ways are so sacrosanct that no fundamental change can be considered, who are already taking pen in hand to protest. I trust that most, though, will remember that a long-standing hallmark of *Analog* is that *anything* can be considered and questioned. Sometimes the answer found will be the one we expected from the beginning; sometimes it won't. All I ask is that you hear me out and *think* about what I say.

I'm confident that some people, having heard this much, will reply: "Now leave us not be hasty. Do we really need to think such drastic thoughts? Is it really necessary that the *people* understand things like SDI and acid rain and the greenhouse effect? After all, ours is a *representative* democracy. The citizens themselves seldom make policy

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decisions about these things. They hire professionals to do that for them. That's what elections are about."

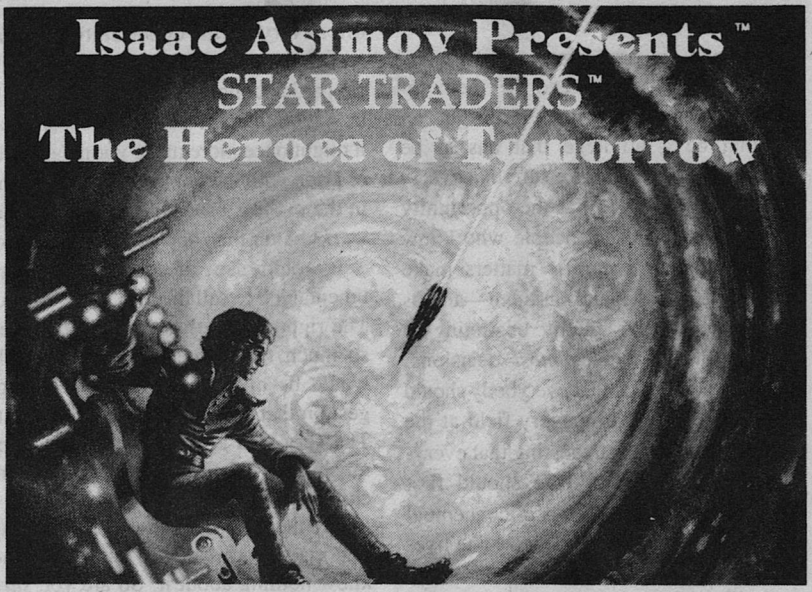
OK—how do they know the professionals they're hiring are *really* professionals and know enough about the job to be trusted with it? "Come on," says my critic from the preceding paragraph. "You don't have to know all about plumbing to hire a plumber."

No, you don't—but you need to know *something* about plumbing to know whether you've hired a good one, or whether you're being overcharged for shoddy or unnecessary work. I consider it part of my responsibility as a homeowner to know something about the workings of my house and car, and cast a critical eye over any work I hire others to do on them. I realize that many others don't, and quite willingly throw themselves on the mercy of whoever is listed in the Yellow Pages as a plumber, mechanic, or doctor. That's your privilege, and no concern of mine, if you're just getting your own roof fixed. I start taking a legitimate interest in it if you're fixing the brakes on a car you're going to drive in my neighborhood. It becomes very much my business if you're hiring somebody to fix *everybody's* roof, including mine.

And that's the situation most closely analogous to democracy in a highly technological world. When you vote, you're not just hiring people to take care of acid rain and energy shortages for you; you're hiring them to do it for me, too. And I do want only competent people working for me, especially on big, important jobs like those. If my help is going to be hired by lots of other people, I want those people to know how to hire *good* help—and that means knowing something about the work to be done. There are those who shrug the whole thing off by saying no one voter's job is very important because it's so much less influential than, say, a senator's. That's true, individually—but votes get added up in very large numbers. One ignorant or misguided voter is of no consequence. Millions of them are *scary!*

So, I repeat, what's to be done about it? If the danger lies in scientific and technological decisions being made by scientifically and technologically unqualified people—politicans and/or voters—one feature of the remedy seems almost tautologically obvious. *Such people must not be allowed to make such decisions.* Given that such decisions must be made by someone, this in turn boils down to two options: *(1)* don't let the excessively ignorant vote, or *(2)* cure their ignorance.

Making a knowledge of basic science, politics, or anything else a prerequisite for voting sounds, of course, a lot like making literacy a prerequisite for voting. That has met with fierce opposition whenever it's been done or proposed in the past, largely on the grounds that it was used as an excuse for *de facto* racial discrimination. But suppose it doesn't have to be that way. Suppose ignorance is a remediable condition (which is, of course, the fundamental presupposition underlying all efforts at education). Then maybe *society* doesn't have to make an either/or choice between those two options. It can offer such a choice to every individual citizen, and let him or her make of it what



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he or she will.

What I am proposing is that society utilize *both* options and tie them together. Instead of being a birthright, let voting be a privilege that has to be earned—and then make sure that everybody who wants to has the opportunity to earn it. Don't let people who know nothing about scientific matters make decisions that depend on them—and as some people are finally beginning to realize, that includes *most* decisions. I'm not suggesting that everybody should be expected to know every field at the Ph.D. level. I am suggesting that everybody who wants to vote should first demonstrate a very basic conceptual understanding of how the world he lives in works. I don't think that's an unreasonable expectation, given an effective educational system.

It's painfully obvious that we don't *have* a very effective educational system now, but if we could manage to build one it would then be reasonable *(1)* to offer everyone the opportunity to use it, and *(2)* to make doing so a prerequisite for participating in government. It would be a monumental job; but if successful, it might once more make voting a matter of pride with the populace at large—and in the process produce government that *works* better than any we've had before.

It would also, of course, be a monumental job to sell the idea to the public. The right to vote has come to be taken so much for granted that most people would be highly indignant at the suggestion that they should have to earn it. The very idea goes against the grain of much that we have all been taught from childhood.

But then, so does the idea of letting important work be done by people who know nothing about it. So are you *sure* the present system is really better? Maximizing popular participation in government is an admirable goal—but if the ruling populace knows nothing about the business at hand, it may be suicidal. ■

●Information's pretty thin stuff, unless mixed with experience.

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Good living requires recognition and avoidance of preconceived notions about others—and oneself.

Miles contemplated the image of the globe glowing above the vid plate, crossed his arms, and stifled queasiness. The planet of Jackson's Whole, glittering, wealthy, corrupt . . . Jacksonians claimed their corruption was entirely imported—if the galaxy was willing to pay for virtue what it paid for vice, the place would be a pilgrimage shrine. In Miles's view this seemed rather like debating which was superior—maggots or the rotten meat they fed off. Still, if Jackson's Whole didn't exist, the galaxy would probably have had to invent it. Its neighbors might feign horror, but they wouldn't permit the place to exist if they didn't find it a secretly useful interface with the sub-economy.

The planet possessed a certain liveliness, anyway. Not as lively as a century or two back, to be sure, in its hijacker-base days. But its cutthroat criminal gangs had evolved into Syndicate monopolies, almost as structured and staid as little governments. An aristocracy, of sorts. Naturally. Miles wondered how much longer the major Houses would be able to fight off the creeping tide of integrity.

House Dyne, detergent banking — launder your money on Jackson's Whole. House Fell, weapons deals with no questions asked. House Bharaputra, illegal genetics. Worse, House Ryoval, whose motto was "Dreams Made Flesh," surely the damnedest—Miles used the adjective precisely—procurer in history. House Hargraves, the galactic fence, prim-faced middlemen for ransom deals—you had to give them credit, hostages exchanged through their good offices came back alive, mostly. And a dozen smaller syndicates, variously and shiftingly allied.

Even we find you useful. Miles touched the control and the vid image vanished. His lip curled in suppressed loathing, and he called up his ordnance inventory for one final check of his shopping list. A subtle shift in the vibrations of the ship around him told him they were matching orbits—the fast cruiser *Ariel* would be docking at Fell Station within the hour.

His console was just extruding the completed data disk of weapons orders when his cabin door chimed, followed by an alto voice over its comm, "Admiral Naismith?"

"Enter." He plucked off the disk and leaned back in his station chair.

Captain Thorne sauntered in with a friendly salute. "We'll be docking in about thirty minutes, sir."

"Thank you, Bel."

Bel Thorne, the *Ariel's* commander, was a Betan hermaphrodite: man/woman descendant of a centuries-past genetic-social experiment every bit as bizarre, in Miles's private opinion, as anything rumored to be done for money by House Ryoval's ethics-free surgeons. A fringe effort of Betan egalitarianism run amok, hermaphroditism had not caught on, and the original idealists' hapless descendants remained a minority on hyper-tolerant Beta Colony. Except for a few stray wanderers like Bel. As a mercenary officer Thorne was conscientious, loyal, and aggressive, and Miles liked him/her/it—Betan custom used the neuter pronoun—a lot. *However . . .*

Miles could smell Bel's floral perfume from here. Bel was emphasizing the female side today. And had been,

increasingly, for the five days of this voyage. Normally Bel chose to come on ambiguous-to-male, soft short brown hair and chiselled, beardless facial features counteracted by the grey-and-white Dendarii military uniform, assertive gestures, and wicked humor. It worried Miles exceedingly to sense Bel soften in his presence.

Turning to his computer console's holovid plate, Miles again called up the image of the planet they were approaching. Jackson's Whole looked demure enough from a distance, mountainous, rather cold—the populated equator was only temperate—ringed in the vid by a lacy schematic net of colored satellite tracks, orbital transfer stations, and authorized approach vectors. "Have you ever been here before, Bel?"

"Once, when I was a lieutenant in Admiral Oser's fleet," said the mercenary. "House Fell has a new baron since then. Their weaponry still has a good reputation, as long as you know what you're buying. Stay away from the sale on neutron hand grenades."

"Heh. For those with strong throwing arms. Fear not, neutron hand grenades aren't on the list." He handed the data disk to Bel.

Bel sidled up and leaned over the back of Miles's station chair to take it. "Shall I grant leaves to the crew while we're waiting for the baron's minions to load cargo? How about yourself? There used to be a hostel near the docks with all the ameneties: pool, sauna, great food . . . " Bel's voice lowered. "I could book a room for two."

"I'd only figured to grant day passes." Necessarily, Miles cleared his throat.

"I *am* a woman, too," Bel pointed out in a murmur.

"Among other things."

"You're so hopelessly monosexual, Miles."

"Sorry." Awkwardly, he patted the hand that had somehow come to rest on his shoulder.

Bel sighed and straightened. "So many are."

Miles sighed, too. Perhaps he ought to make his rejection more emphatic —this was only about the seventh time he'd been around with Bel on this subject. It was almost ritualized by now, almost, but not quite, a joke. You had to give the Betan credit for either optimism or obtuseness. . . . or, Miles's honesty added, genuine feeling. If he turned around now, he knew, he might surprise an essential loneliness in the hermaphrodite's eyes, never permitted on the lips. He did not turn around.

And who was he to judge another. Miles reflected ruefully, whose own body brought him so little joy? Crippled in a congenital accident, all his homeworld's medical resources had only half-healed him. At full growth he had only achieved 4 foot 9. Oversized head, face pale and sharp-featured against his dark hair; short neck, twisted spine, brittle bones. Mismatched with a soul's passion for soldiering that would not be denied. He glanced down at the grey Dendarii officer's uniform he wore. The uniform he had won. *If you can't be seven feet tall, be seven feet smart.* His reason had so far failed to present him with a solution to the problem of Thorne, though.

"Have you ever thought of going

back to Beta Colony, and seeking one of your own?" Miles asked seriously.

Thorne shrugged. "Too boring. That's why I left. It's so very safe, so very narrow. . . ."

"Mind you, a great place to raise kids." One corner of Miles's mouth twisted up.

Thorne grinned. "You got it. You're an almost perfect Betan, y'know? Almost. You have the accent, the in-jokes. . . ."

Miles went a little still. "Where do I fail?"

Thorne touched Miles's cheek; Miles flinched.

"Reflexes," said Thorne.

"Ah."

"I won't give you away."

"I know."

Bel was leaning in again. "I could polish that last edge. . . ."

"Never mind," said Miles, slightly flushed. "We have a mission."

"Inventory," said Thorne scornfully.

"That's not a mission," said Miles, "that's a cover."

"Ah ha." Thorne straightened up. "At last."

"At last?"

"It doesn't take a genius. We came to purchase ordnance, but instead of taking the ship with the biggest cargo capacity, you chose the *Ariel*—the fleet's fastest. There's no deader dull routine than inventory, but instead of sending a perfectly competent quartermaster, you're overseeing it personally."

"I do want to make contact with the new Baron Fell," said Miles mildly. "House Fell is the biggest arms supplier this side of Beta Colony, and a lot less picky about who its customers are. If I like the quality of the initial purchase, they could become a regular supplier."

"A quarter of Fell's arms are Betan manufacture, marked up," said Thorne. "Again, ha."

"And while we're here," Miles went on, "a certain middle-aged man is going to present himself and sign on to the Dendarii Mercenaries as a medtech. At that point all Station passes are cancelled, we finish loading cargo as quickly as possible, and we leave."

Thorne grinned in satisfaction. "A pick-up. Very good. I assume we're being well paid?"

"Very. If he arrives at his destination alive. The man happens to be the top research geneticist of House Bharaputra Laboratories. He's been offered asylum by a planetary government capable of protecting him from the long arms of Baron Luigi Bharaputra's enforcers. His soon-to-be-former employer is expected to be highly irate at the lack of a month's notice. We are being paid to deliver him to his new masters alive and not, ah, forcibly debriefed of all his trade secrets.

"Since House Bharaputra could probably buy and sell the whole Dendarii Free Mercenary Fleet twice over out of petty cash, I would prefer we not have to deal with Baron Luigi's enforcers either. So we shall be innocent suckers. We'll just say, All we did was hire a bloody medtech, sir. And we shall be irate ourselves when he deserts after we arrive at fleet rendezvous off Escobar."

"Sounds good to me," conceded Thorne. "Simple."

"So I trust," Miles sighed hopefully.

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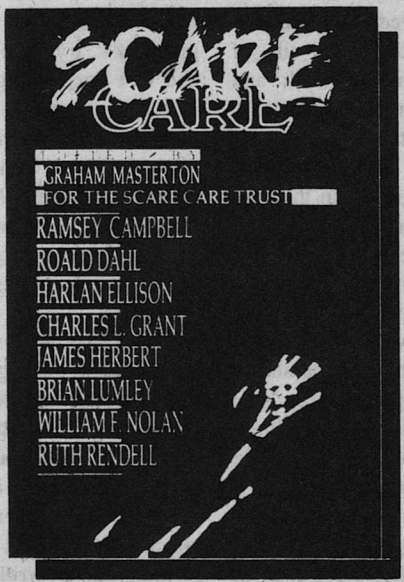

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TOR® HORROR

Why, after all, shouldn't things run to plan, just this once?

The purchasing offices and display areas for House Fell's lethal wares were situated not far from the docks, and most of House Fell's smaller customers never penetrated further into Fell Station. But shortly after Miles and Thorne placed their order—about as long as needed to verify a credit chit—an obsequious person in the green silk of House Fell's uniform appeared, and pressed an invitation into Admiral Naismith's hand to a reception in the Baron's personal quarters.

Four hours later, giving up the pass cube to Baron Fell's major domo at the sealed entrance to the station's private sector, Miles checked Thorne and himself over for their general effect. Dendarii dress uniform was a grey velvet tunic with silver buttons on the shoulders and white edging, matching grey trousers with white side piping, and grey synthasuede boots—perhaps just a trifle effete? Well, he hadn't designed it, he'd just inherited it. Live with it.

The interface to the private sector was highly interesting. Miles's eye took in the details while the majordomo scanned them for weapons. Life-support—in fact, all systems—appeared to be run separately from the rest of the station. The area was not only sealable, it was detachable. In effect, not Station but Ship—engines and armament around here somewhere, Miles bet, though it could be lethal to go looking for them unescorted. The majordomo ushered them through, pausing to announce them on his wrist comm: "Admiral Miles Naismith, commanding, Dendarii Free Mercenary Fleet. Captain Bel Thorne, commanding the fast cruiser *Ariel*, Dendarii Free Mercenary Fleet." Miles wondered who was on the other end of the comm.

The reception chamber was large and gracefully appointed, with iridescent floating staircases and levels creating private spaces without destroying the illusion of openness. Every exit (Miles counted six) had a large green-garbed guard by it, trying to look like a servant and not succeeding very well. One whole wall was a vertigo-inducing transparent viewport overlooking Fell Station's busy docks and the bright curve of Jackson's Whole bisecting the star-spattered horizon beyond. A crew of elegant women in green silk saris rustled among the guests offering food and drink.

Grey velvet, Miles decided after one glance at the other guests, was a positively demure choice of garb. He and Bel would blend right into the walls. The thin scattering of fellow privileged customers wore a wide array of planetary fashions. But they were a wary bunch, little groups sticking together, no mingling. Guerrillas, it appeared, did not speak to mercenaries, nor smugglers to revolutionaries; the Gnostic Saints, of course, spoke only to the One True God, and perhaps to Baron Fell.

"Some party," commented Bel. "I went to a pet show with an atmosphere like this once. The high point was when somebody's Tau Cetan beaded lizard got loose and ate the Best-In-Show from the canine division."

"Hush," Miles grinned out of the corner of his mouth. "This is business."

A green-sari'd woman bowed silently before them, offering a tray. Thorne raised a brow at Miles—*do we?* . . .

"Why not?" Miles murmured. "We're paying for it, in the long run. I doubt the baron poisons his customers, it's bad for business. Business is emperor, here. *Laissez-faire* capitalism gone completely over the edge." He selected a pink tid-bit in the shape of a lotus and a mysterious cloudy drink. Thorne followed suit. The pink lotus, alas, turned out to be some sort of raw fish. It squeaked against his teeth. Miles, committed, swallowed it anyway. The drink was potently alcoholic, and after a sip to wash down the lotus he regretfully abandoned it on the first level surface he could find. His dwarfish body refused to handle alcohol, and he had no desire to meet Baron Fell while either semi-comatose or giggling uncontrollably. The more metabolically fortunate Thorne kept beverage in hand.

A most extraordinary music began from somewhere, a racing rich complexity of harmonics. Miles could not identify the instrument—instruments, surely. He and Thorne exchanged a glance, and by mutual accord drifted toward the sound. Around a spiraling staircase, backed by the panoply of station, planet, and stars, they found the musician. Miles's eyes widened. *House Ryoval's surgeons have surely gone too far this time.* . . .

Little decorative colored sparkles defined the spherical field of a large null-gee bubble. Floating within it was a woman. Her ivory arms flashed against her green silk clothes as she played. *All four* of her ivory arms . . . She wore a flowing, kimono-like belted jacket and matching shorts, from which the second set of arms emerged where her legs should have been. Her hair was short and soft and ebony black. Her eyes were closed, and her rose-tinted face bore the repose of an angel, high and distant and terrifying.

Her strange instrument was fixed in air before her, a flat polished wooden frame strung across both top and bottom with a bewildering array of tight gleaming wires, soundboard between. She struck the wires with four felted hammers with blinding speed, both sides at once, her upper hands moving at counterpoint to her lowers. Music poured forth in a cascade.

"Good God," said Thorne, "it's a quaddie."

"It's a what?"

"A quaddie. She's a long way from home."

"She's—not a local product?"

"By no means."

"I'm relieved. I think. Where the devil does she come from, then?"

"About two hundred years ago—about the time hermaphrodites were being invented," a peculiar wryness flashed across Thorne's face, "there was this rush of genetic experimentation on humans, in the wake of the development of the practical uterine replicator. Followed shortly by a rush of laws restricting such, but meanwhile, somebody thought they'd make a race of free fall dwellers. Then artificial gravity came in and blew them out of business. The quaddies fled—their descendants ended up on the far side of nowhere, way beyond Earth from us in the Nexus. They're rumored to keep to themselves, mostly. Very unusual, to see one this

side of Earth. H'sh." Lips parted, Thorne tracked the music.

As unusual as finding a Betan hermaphrodite in a free mercenary fleet, Miles thought. But the music deserved undivided attention, though few in this paranoid crowd seemed to even be noticing it. A shame. Miles was no musician, but even he could sense an intensity of passion in the playing that went beyond talent, reaching for genius. An evanescent genius, sounds woven with time and, like time, forever receding beyond one's futile grasp into memory alone.

The outpouring of music dropped to a haunting echo, then silence. The four-armed musician's blue eyes opened, and her face came back from the ethereal to the merely human, tense and sad.

"Ah," breathed Thorne, stuck its empty glass under its arm, raised hands to clap, then paused, hesitant to become conspicuous in this indifferent chamber.

Miles was all for being inconspicuous. "Perhaps you can speak to her," he suggested by way of an alternative.

"You think?" Brightening, Thorne tripped forward, swinging down to abandon the glass on the nearest handy floor and raising splayed hands against the sparkling bubble. The hermaphrodite mustered an entranced, ingratiating smile. "Uh . . . " Thorne's chest rose and fell.

Good God, Bel, tongue-tied? Never thought I'd see it. "Ask her what she calls that thing she plays," Miles supplied helpfully.

The four-armed woman tilted her head curiously, and starfished gracefully over her boxy instrument to hover politely before Thorne on the other side of the glittering barrier. "Yes?"

"What do you call that extraordinary instrument?" Thorne asked.

"It's a double-sided hammer dulcimer, ma'am—sir. . . . " her servant-to-guest dull tone faltered a moment, fearing to give insult, "Officer."

"Captain Bel Thorne," Bel supplied instantly, beginning to recover accustomed smooth equilibrium. "Commanding the Dendarii fast cruiser *Ariel*. At your service. How ever did you come to be here?"

"I had worked my way to Earth, I was seeking employment, and Baron Fell hired me." She tossed her head, as if to deflect some implied criticism, though Bel had offered none.

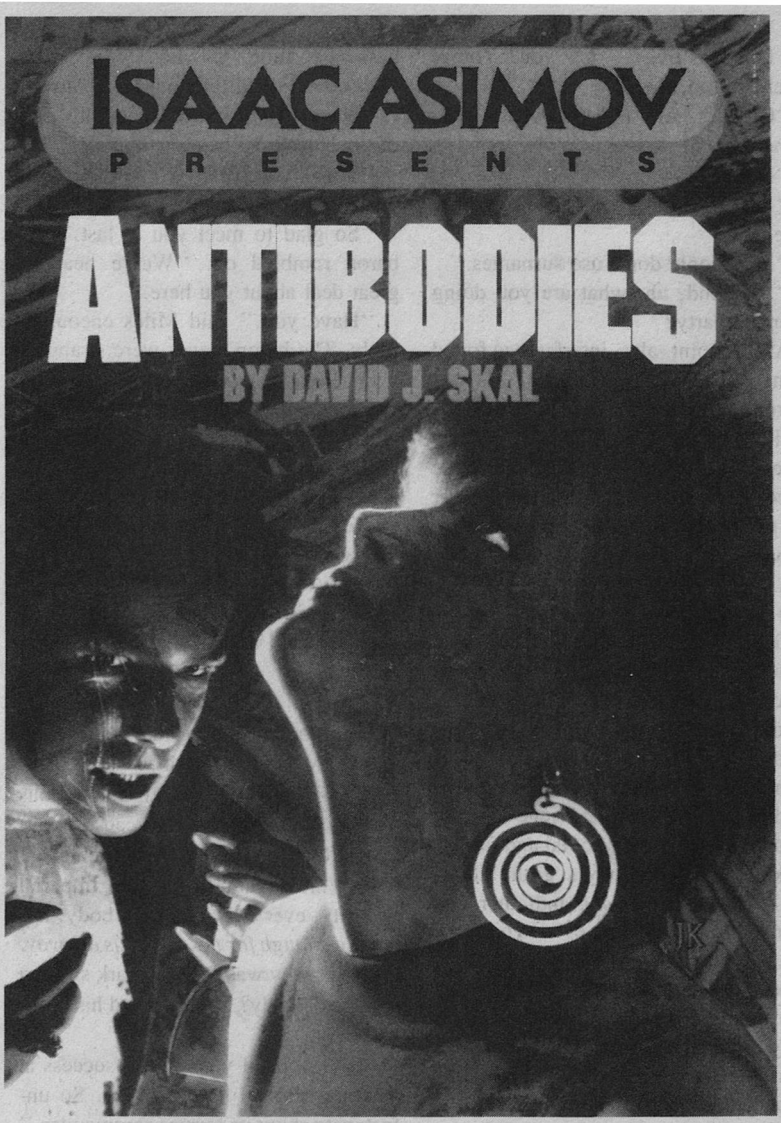
"You are a true quaddie?"

"You've heard of my people?" Her dark brows rose in surprise. "Most people I encounter here think I am a *manufactured* freak." A little sardonic bitterness edged her voice.

Thorne cleared its throat. "I'm Betan, myself. I've followed the history of the early genetics explosion with a rather more personal interest." Thorne cleared its throat again, "Betan hermaphrodite, you see," and waited anxiously for the reaction.

Damn. Bel never waited for reactions, Bel sailed on and let the chips fall anyhow. *I wouldn't interfere with this for all the world.* Miles faded back slightly, rubbing his lips to wipe off a twitching grin as all Thorne's most masculine mannerisms reasserted themselves from spine to fingertips and outward into the aether.

Her head tilted in interest. One upper hand rose to rest on the sparkling barrier



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not far from Bel's. "*Are* you? You're a genetic too, then."

"Oh, yes. And tell me, what's your name?"

"Nicol."

"Nicol. Is that all? I mean, it's lovely."

"My people don't use surnames."

"Ah. And, uh, what are you doing after the party?"

At this point, alas, interference found them. "Heads up, *Captain,*" Miles murmured. Thorne drew up instantly, cool and correct, and followed Miles's gaze. The quaddie floated back from the force barrier and bowed her head over her hands held palm-to-palm and palm-to-palm as a man approached. Miles, too, came to a polite species of attention.

Georish Stauber, Baron Fell, was a surprisingly old man to have succeeded so recently to his position, Miles thought. In the flesh he looked older than the holovid Miles had viewed of him at his own mission briefing. The baron was balding, with a white fringe of hair around his shiny pate, jovial and fat. He looked like somebody's grandfather. Not Miles's, Miles's grandfather had been lean and predatory even in his great age. And the old Count's title had been as real as such things got, not the courtesy-nobility of a Syndicate survivor. Jolly red cheeks or no, Miles reminded himself, Baron Fell had climbed a pile of bodies to attain this high place.

"Admiral Naismith. Captain Thorne. Welcome to Fell Station," rumbled the baron, smiling.

Miles swept him an aristocratic bow. Thorne somewhat awkwardly followed suit. Ah. He must copy that awkwardness next time. Of such little details were cover identities made. And blown.

"Have my people been taking care of your needs?"

"Thank you, yes." So far the proper businessmen.

"So glad to meet you at last," the baron rumbled on. "We've heard a great deal about you here."

"Have you," said Miles encouragingly. The baron's eyes were strangely avid. *Quite a glad-hand for a little tin-pot mercenary, eh?* This was a little more stroke than was reasonable even for a high-ticket customer. Miles banished all hint of wariness from his return smile. *Patience. Let the challenge emerge, don't rush to meet what you cannot yet see.* "Good things, I hope."

"Remarkable things. Your rise has been as rapid as your origins are mysterious."

Hell, hell, what kind of bait was this? Was the baron hinting that he actually knew "Admiral Naismith's" real identity? This could be sudden and serious trouble. No—fear outran its cause. Wait. Forget that such a person as Lieutenant Lord Vorkosigan, Barrayaran Imperial Security, ever existed in this body. *It's not big enough for the two of us anyway, boy.* Yet why was this fat shark smiling so ingratiatingly? Miles cocked his head, neutrally.

"The story of your fleet's success at Vervain reached us even here. So unfortunate about its former commander."

Miles stiffened. "I regret Admiral Oser's death."

The baron shrugged philosophically. "Such things happen in the business. Only one can command."

"He could have been an outstanding subordinate."

"Pride is so dangerous," smiled the baron.

Indeed. Miles bit his tongue. *So he thinks I "arranged" Oser's death. So let him.* That there was one less mercenary than there appeared in this room, that the Dendarii were now, through Miles, an arm of the Barrayaran Imperial Service so covert most of them didn't even know it themselves . . . it would be a dull Syndicate baron who couldn't find profit in those secrets somewhere. Miles matched the baron's smile and added nothing.

"You interest me exceedingly," continued the baron. "For example, there's the puzzle of your apparent age. And your prior military career."

If Miles had kept his drink, he'd have knocked it back in one gulp right then. He clasped his hands convulsively behind his back instead. Dammit, the pain lines just didn't age his face enough. If the baron was indeed seeing right through the pseudo-mercenary to the twenty-three-year-old Security lieutenant—and yet, he usually carried it off—

The baron lowered his voice. "Do the rumors run equally true about your Betan rejuvenation treatment?"

So *that's* what he was on about. Miles felt faint with relief. "What interest could you have in such treatments, my lord?" he gibbered lightly. "I thought Jackson's Whole was the home of practical immortality. It's said that there are some here on their third cloned body."

"I am not one of them," said the baron rather regretfully.

Miles's brows rose in genuine surprise. Surely this man didn't spurn the process as murder. "Some unfortunate medical impediment?" he said, injecting polite sympathy into his voice. "My regrets, sir."

"In a manner of speaking." The baron's smile revealed a sharp edge. "The brain transplant operation itself kills a certain irreducible percentage of patients—"

Yeah, thought Miles, *starting with 100 percent of the clones, whose brains are flushed to make room . . .*

"—another percentage suffer varying sorts of permanent damage. Those are the risks anyone must take for the reward."

"But the reward is so great."

"But then there are a certain number of patients, indistinguishable from the first group, who do not die on the operating table by accident. If their enemies have the subtlety and clout to arrange it. I have a number of enemies, Admiral Naismith."

Miles made a little who-would-think-it gesture, flipping up one hand, and continued to cultivate an air of deep interest.

"I calculate my present chances of surviving a brain transplant to be rather worse than the average," the baron went on. "So I've an interest in alternatives." He paused expectantly.

"Oh," said Miles. Oh, indeed. He regarded his fingernails and thought fast. "It's true, I once participated in an . . . unauthorized experiment. A premature one, as it happens, pushed too eagerly from animal to human subjects. It was not successful."

"No?" said the baron. "You appear in good health."

Miles shrugged. "Yes, there was

some benefit to muscles, skin tone, hair. But my bones are the bones of an old man, fragile." *True.* "Subject to acute osteo-inflammatory attacks—there are days when I can't walk without medication." *Also true, dammit.* A recent and unsettling medical development. "My life expectancy is not considered good." *For example, if certain parties here ever figure out who "Admiral Naismith" really is, it could go down to as little as fifteen minutes.* "So unless you're extremely fond of pain and think you would enjoy being crippled, I fear I must dis-recommend the procedure."

The baron looked him up and down. Disappointment pulled down his mouth. "I see."

Bel Thorne, who knew quite well there was no such thing as the fabled "Betan rejuvenation treatment," was listening with well-concealed enjoyment and doing an excellent job of keeping the smirk off its face. Bless its little black heart.

"Still," said the baron, "your . . . scientific acquaintance may have made some progress in the intervening years."

"I fear not," said Miles. "He died." He spread his hands helplessly. "Old age."

"Oh." The baron's shoulders sagged slightly.

"Ah, there you are, Fell," a new voice cut across them. The baron straightened and turned.

The man who had hailed him was as conservatively dressed as Fell, and flanked by a silent servant with "bodyguard" written all over him. The bodyguard wore a uniform, a high-necked red silk tunic and loose black trousers, and was unarmed. Everyone on Fell Station went unarmed except Fell's men, the place had the most strictly enforced weapons regs Miles had ever encountered. But the pattern of calluses on the lean bodyguard's hands suggested he might not need weapons. His eyes flickered and his hands shook just slightly, a hyper-alertness induced by artificial aids—if ordered, he could strike with blinding speed and adrenalin-insane strength. He would also retire young, metabolically crippled for the rest of his short life.

The man he guarded was also young—some great lord's son? Miles wondered. He had long shining black hair dressed in an elaborate braid, smooth dark olive skin, and a high-bridged nose. He couldn't be older than Miles's real age, yet he moved with a mature assurance.

"Ryoval," Baron Fell nodded in return, as a man to an equal, not a junior. Still playing the genial host, Fell added, "Officers, may I introduce Baron Ryoval of House Ryoval. Admiral Naismith, Captain Thorne. They belong to that Illyrican-built mercenary fast cruiser in dock, Ry, that you may have noticed."

"Haven't got your eye for hardware, I'm afraid, Georish." Baron Ryoval bestowed a nod upon them, of a man being polite to his social inferiors for the principle of it. Miles bowed clumsily in return.

Dropping Miles from his attention with an almost audible thump, Ryoval stood back with his hands on his hips and regarded the null-gee bubble's inhabitant. "My agent didn't exaggerate her charms."

Fell smiled sourly. Nicol had withdrawn—recoiled—when Ryoval first

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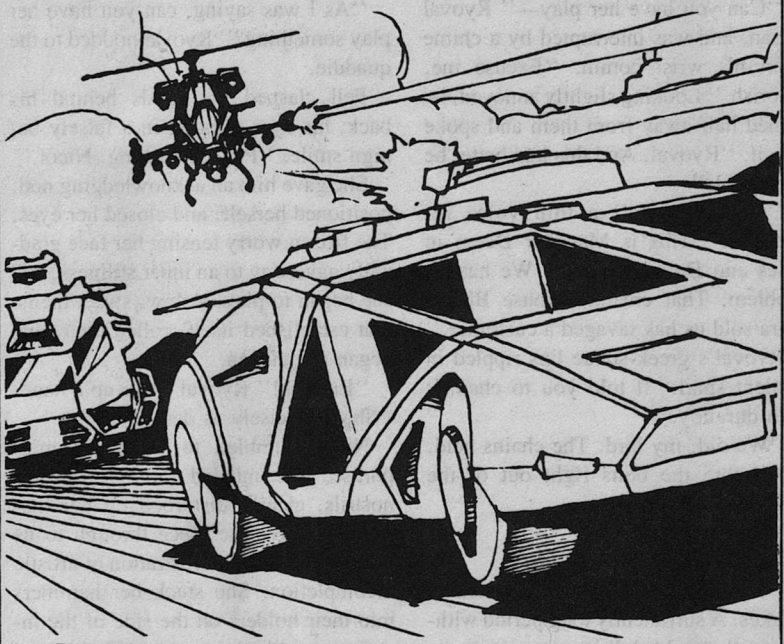

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approached, and now floated behind her instrument, fussing with its tuning. Pretending to be fussing with its tuning. Her eyes glanced warily at Ryoval, then returned to her dulcimer as if it might put some magic wall between them.

"Can you have her play—" Ryoval began, and was interrupted by a chime from his wrist comm. "Excuse me, Georish." Looking slightly annoyed, he turned half-away from them and spoke into it. "Ryoval. And this had better be important."

"Yes, m'lord," a thin voice responded. "This is Manager Deem in Sales and Demonstrations. We have a problem. That creature House Bharaputra sold us has savaged a customer."

Ryoval's greek-statue lips rippled in a silent snarl. "I told you to chain it with duralloy."

"We did, my lord. The chains held, but it tore the bolts right out of the wall."

"Stun it."

"We have."

"Then punish it suitably when it awakes. A sufficiently long period without food should dull its aggression; its metabolism is unbelievable."

"What about the customer?"

"Give him whatever comforts he asks for. On the House."

"I . . . don't think he'll be in shape to appreciate them for quite some time. He's in the clinic now. Still unconscious."

Ryoval hissed. "Put my personal physician on his case. I'll take care of the rest when I get back downside, in about six hours. Ryoval out." He snapped the link closed. "Morons," he growled. He took a controlled, meditative breath, and recalled his social manner as if booting it up out of some stored memory bank. "Pardon the interruption, please, Georish."

Fell waved an understanding hand, as if to say, *Business*.

"As I was saying, can you have her play something?" Ryoval nodded to the quaddie.

Fell clasped his hands behind his back, his eyes glinting in a falsely benign smile. "Play something, Nicol."

She gave him an acknowledging nod, positioned herself, and closed her eyes. The frozen worry tensing her face gradually gave way to an inner stillness, and she began to play, a slow, sweet theme that established itself, rolled over, and began to quicken.

"Enough!" Ryoval flung up a hand. "She's precisely as described."

Nicol stumbled to a halt in midphrase. She inhaled through pinched nostrils, clearly disturbed by her inability to drive the piece through to its destined finish, the frustration of artistic incompletion. She stuck her hammers into their holders on the side of the instrument with short, savage jerks, and crossed her upper and lower arms both. Thorne's mouth tightened, and it crossed its arms in unconscious echo. Miles bit his lip uneasily.

"My agent conveyed the truth," Ryoval went on.

"Then perhaps your agent also conveyed my regrets," said Fell dryly.

"He did. But he wasn't authorized to offer more than a certain standard ceiling. For something so unique, there's no substitute for direct contact."

"I happen to be enjoying her skills where they are," said Fell. "At my age,

enjoyment is much harder to obtain than money."

"So true. Yet other enjoyments might be substituted. I could arrange something quite special. Not in the catalog."

"Her *musical* skills, Ryoval. Which are more than special. They are unique. Genuine. Not artificially augmented in any way. Not to be duplicated in your laboratories."

"My laboratories can duplicate anything, sir." Ryoval smiled at the implied challenge.

"Except originality. By definition."

Ryoval spread his hands in polite acknowledgment of the philosophical point. Fell, Miles gathered, was not just enjoying the quaddie's musical talent, he was vastly enjoying the possession of something his rival keenly wanted to buy, that he had absolutely no need to sell. One-upsmanship was a powerful pleasure. It seemed even the famous Ryoval was having a tough time coming up with a better—and yet, if Ryoval could find Fell's price, what force on Jackson's Whole could save Nicol? Miles suddenly realized he knew what Fell's price could be. Would Ryoval figure it out, too?

Ryoval pursed his lips. "Let's discuss a tissue sample, then. It would do her no damage, and you could continue to enjoy her unique services uninterrupted."

"It would damage her uniqueness. Circulating counterfeits always brings down the value of the real thing, you know that, Ry," grinned Baron Fell.

"Not for some time," Ryoval pointed out. "The lead time for a mature clone is at least ten years—ah, but you know that." He reddened and made a little apologetic bow, as if he realized he'd just committed some *faux pas*.

By the thinning of Fell's lips, he had. "Indeed," said Fell coldly.

At this point Bel Thorne, tracking the interplay, interrupted in hot horror, "You can't sell her tissues! You don't own them. She's not some Jackson's Whole construct, she's a freeborn galactic citizen!"

Both barons turned to Bel as if the mercenary were a piece of furniture that had suddenly spoken. Out of turn. Miles winced.

"He can sell her contract," said Ryoval, mustering a glassy tolerance. "Which is what we are discussing. A *private* discussion."

Bel ignored the hint. "On Jackson's Whole, what practical difference does it make if you call it a contract or call it flesh?"

Ryoval smiled a little cool smile. "None whatsoever. Possession is rather more than nine points of the law, here."

"It's totally illegal!"

"Legal, my dear—ah—you are Betan, aren't you? That explains it," said Ryoval. "And illegal, is whatever the planet you are on chooses to call so and is able to enforce. I don't see any Betan enforcers around here to impose their peculiar version of morality on us all, do you, Fell?"

Fell was listening with raised brows, caught between amusement and annoyance.

Bel twitched. "So if I were to pull out a weapon and blow your head off, it would be perfectly legal?"

The bodyguard tensed, balance and center-of-gravity flowing into launch position.

"Quash it, Bel," Miles muttered under his breath.

But Ryoval was beginning to enjoy baiting his Betan interruptor. "You have no weapon. But legality aside, my subordinates have instructions to avenge me. It is, as it were, a natural or virtual law. In effect you'd find such an ill-advised impulse to be illegal indeed."

Baron Fell caught Miles's eye and tilted his head just slightly. Time to intervene. "Time to move on, Captain," Miles said. "We aren't the baron's only guests here."

"Try the hot buffet," suggested Fell affably.

Ryoval pointedly dropped Bel from his attention and turned to Miles. "Do stop by my establishment if you get downside, Admiral. Even a Betan could stand to expand the horizons of his experience. I'm sure my staff could find something of interest in your price range."

"Not any more," said Miles. "Baron Fell already has our credit chit."

"Ah, too bad. Your next trip, perhaps." Ryoval turned away in easy dismissal.

Bel didn't budge. "You can't sell a galactic citizen down there," gesturing jerkily to the curve of the planet beyond the viewport. The quaddie Nicol, watching from behind her dulcimer, had no expression at all upon her face, but her intense blue eyes blazed.

Ryoval turned back, feigning sudden surprise. "Why, Captain, I just realized. Betan—you must be a genuine genetic hermaphrodite. You possess a marketable rarity yourself. I can offer you an eye-opening employment experience at easily twice your current rate of pay. And you wouldn't even have to get shot at. I guarantee you'd be extremely popular. Group rates."

Miles swore he could see Thorne's blood pressure skyrocketing as the meaning of what Ryoval had just said sunk in. The hermaphrodite's face darkened, and it drew breath. Miles reached up and grasped Bel by the shoulder, hard. The breath held.

"No?" said Ryoval, cocking his head. "Oh, well. But seriously, I would pay well for a tissue sample, for my files."

Bel's breath exploded. "My clone-siblings, to be—be—some sort of sex-slaves into the next century! Over my dead body—or yours—you—"

Bel was so mad it was stuttering, a phenomenon Miles had never seen in seven years' acquaintance, including combat.

"So Betan," smirked Ryoval.

"Stop it, Ry," growled Fell.

Ryoval sighed. "Oh, very well. But it's so easy."

"We can't win, Bel," hissed Miles. "It's time to withdraw." The bodyguard was quivering.

Fell gave Miles an approving nod.

"Thank you for your hospitality, Baron Fell," Miles said formally. "Good day, Baron Ryoval."

"Good day, Admiral," said Ryoval, regretfully giving up what was obviously the best sport he'd had all day. "You seem a cosmopolitan sort, for a Betan. Perhaps you can visit us sometime without your moral friend, here."

A war of words should be won with words. "I don't think so," Miles mur-

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mured, racking his brain for some stunning insult to withdraw on.

"What a shame," said Ryoval. "We have a dog-and-dwarf act I'm sure you'd find *fascinating.*"

There was a moment's absolute silence.

"Fry 'em from orbit," Bel suggested tightly.

Miles grinned through clenched teeth, bowed, and backed off, Bel's sleeve clutched firmly in his hand. As he turned he could hear Ryoval laughing.

Fell's majordomo appeared at their elbows within moments. "This way to the exit, please, officers," he smiled. Miles had never before been thrown out of any place with such exquisite politeness.

Back aboard the *Ariel* in dock, Thorne paced the wardroom while Miles sat and sipped coffee as hot and black as his own thoughts.

"Sorry I lost my temper with that squirt Ryoval," Bel apologized gruffly.

"Squirt, hell," said Miles. "The brain in that body has got to be at least a hundred years old. He played you like a violin. No. We couldn't expect to count coup on him. I admit, it would have been nice if you'd had the sense to shut up." He sucked air to cool his scalded tongue.

Bel made a disturbed gesture of acknowledgement and paced on. "And that poor girl, trapped in that bubble—I had one chance to talk to her, and I blew it—I blithered. . . ."

She really had brought out the male in Thorne, Miles reflected wryly. "Happens to the best of us," he murmured. He smiled into this coffee, then frowned. No. Better not to encourage Thorne's interest in the quaddie after all. She was clearly much more than just one of Fell's house servants. They had one ship here, a crew of twenty; even if he had the whole Dendarii fleet to back him he'd want to think twice about offending Baron Fell in Fell's own territory. They had a mission. Speaking of which, where was their blasted pickup? Why hadn't he yet contacted them as arranged?

The intercom in the wall bleeped.

Thorne strode to it. "Thorne here."

"This is Corporal Nout at the portside docking hatch. There's a . . . woman here who's asking to see you."

Thorne and Miles exchanged a raised-brows glance. "What's her name?" asked Thorne.

An off-side mumble, then, "She says it's Nicol."

Thorne grunted in surprise. "Very well. Have her escorted to the wardroom."

"Yes, Captain." The corporal failed to kill his intercom before turning away, and his voice drifted back, " . . . stay in this outfit long enough, you see one of *everything.*"

Nicol appeared in the doorway balanced in a float chair, a hovering tubular cup that seemed to be looking for its saucer, enamelled in a blue that precisely matched her eyes. She slipped it through the doorway as easily as a woman twitching her hips, zipped to a halt near Miles's table, and adjusted the height to that of a person sitting. The controls, run by her lower hands, left her uppers entirely free. The lower body support must have been custom-designed just for her. Miles watched her

manuever with great interest. He hadn't been sure she could even live outside her null-gee bubble. He'd expected her to be weak. She didn't look weak. She looked determined. She looked at Thorne.

Thorne looked all cheered up. "Nicol. How nice to see you again."

She nodded shortly. "Captain Thorne. Admiral Naismith." She glanced back and forth between them, and fastened on Thorne. Miles thought he could see why. He sipped coffee and waited for developments.

"Captain Thorne. You are a mercenary, are you not?"

"Yes . . . "

"And . . . pardon me if I misunderstood, but it seemed to me you had a certain . . . empathy for my situation. An understanding of my position."

Thorne rendered her a slightly idiotic bow. "I understand you are dangling over a pit."

Her lips tightened, and she nodded mutely.

"She got herself into it," Miles pointed out.

Her chin lifted. "And I intend to get myself out of it."

Miles turned a hand palm out, and sipped again.

She readjusted her float chair, a nervous gesture ending at about the same altitude it began.

"It seems to me," said Miles, "that Baron Fell is a formidable protector. I'm not sure you have anything to fear from Ryoval's, er, carnal interest in you as long as Fell's in charge."

"Baron Fell is dying." She tossed her head. "Or at any rate, he thinks he is."

"So I gathered. Why doesn't he have a clone made?"

"He did. It was all set up with House Bharaputra. The clone was fourteen years old, full-sized. Then a couple of months ago, somebody assassinated the clone. The baron still hasn't found out for sure who did it, though he has a little list. Headed by his half-brother."

"Thus trapping him in his aging body. What a . . . fascinating tactical maneuver," Miles mused. "What's this unknown enemy going to do next, I wonder? Just wait?"

"I don't know," said Nicol. "The Baron's had another clone started, but it's not even out of the replicator yet. Even with growth accelerators it'd be years before it would be mature enough to transplant. And . . . it has occurred to me that there are a number of ways the baron could die besides ill health between now and then."

"An unstable situation," Miles agreed.

"I want out. I want to buy passage out."

"Then why, he asked," said Miles dryly, "don't you just go plunk your money down at the offices of one of the three galactic commercial passenger lines that dock here, and buy a ticket?"

"It's my contract," said Nicol. "When I signed it back on Earth, I didn't realize what it would mean once I got to Jackson's Whole. I can't even buy my way out of it, unless the baron chooses to let me. And somehow . . . it gets much worse before my time is up."

"How much time?" asked Thorne.

"Five more years."

"Ouch," said Thorne sympathetically.

"So you, ah, want us to help you jump a Syndicate contract," said Miles, making little wet coffee rings on the table with the bottom of his mug. "Smuggle you out in secret, I suppose."

"I can pay. I can pay more right now than I'll be able to next year. This wasn't the gig I expected, when I came here. There was talk of recording a vid demo—it never happened. I don't think it's ever going to happen. I have to be able to reach a wider audience, if I'm ever to pay my way back home. Back to my people. I want . . . *out* of here, before I fall down that gravity well." She jerked an upper thumb in the general direction of the planet they orbited. "People go downside here, who never come up again." She paused. "Are you *afraid* of Baron Fell?"

"No!" said Thorne, as Miles said, "Yes." They exchanged a sardonic look.

"We are inclined to be careful of Baron Fell," Miles suggested. Thorne shrugged agreement.

She frowned, and maneuvered to the table. She drew a wad of assorted planetary currencies out of her green silk jacket and laid it in front of Miles. "Would this bolster your nerve?"

Thorne fingered the stack, flipped through it. At least a couple thousand Betan dollars worth, at conservative estimate, mostly in middle denominations, though a Betan single topped the pile, camouflaging its value to a casual glance. "Well," said Thorne, glancing at Miles, "and what do we mercenaries think of that?"

Miles leaned back thoughtfully in his chair. The kept secret of Miles's identity wasn't the only favor Thorne could call in if it chose. Miles remembered the day Thorne had helped capture an asteroid mining station and the pocket dreadnought *Triumph* for him with nothing but sixteen troops in combat armor and a hell of a lot of nerve. "I encourage creative financing on the part of my commanders," he said at last. "Negotiate away, Captain."

Thorne smiled, and pulled the Betan dollar off the stack. "You have the right idea," Thorne said to the musician, "but the amount is wrong."

Her hand went uncertainly to her jacket and paused, as Thorne pushed the rest of the stack of currency, minus the single, back to her. "What?"

Thorne picked up the single and snapped it a few times. "This is the right amount. Makes it an official contract, you see." Bel extended a hand to her; after a bewildered moment, she shook it. "Deal," said Thorne happily.

"Hero," said Miles, holding up a warning finger, "beware, I'll call in my veto if you can't come up with a way to bring this off in dead secret. That's my cut of the price."

"Yes, *sir*," said Thorne.

Several hours later, Miles snapped awake in his cabin aboard the *Ariel* to an urgent bleeping from his comconsole. Whatever he had been dreaming was gone in the instant, though he had the vague idea it had been something unpleasant. Biological and unpleasant. "Naismith here."

"This is the duty officer in Nav and Com, sir. You have a call originating from the downside commercial comm net. He says to tell you it's Vaughn."

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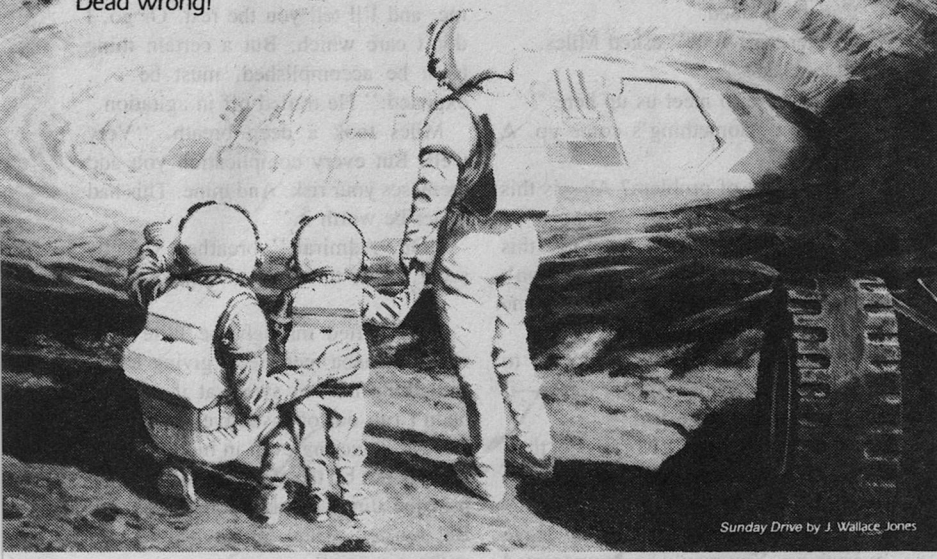

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Vaughn was the agreed-upon code name of their pick-up. His real name was Dr. Canaba. Miles grabbed his uniform jacket and shrugged it on over his black T-shirt, passed his hands futilely through his hair, and slid into his console station chair. "Put him through."

The face of a man on the high side of middle age materialized above Miles's vid plate. Tan-skinned, racially indeterminate features, short wavy hair greying at the temples; more arresting was the intelligence that suffused those features and quickened the brown eyes. *Yep, that's my man,* thought Miles with satisfaction. *Here we go.* But Canaba looked more than tense. He looked distraught.

"Admiral Naismith?"

"Yes. Vaughn?"

Canaba nodded.

"Where are you?" asked Miles.

"Downside."

"You were to meet us up here."

"I know. Something's come up. A problem."

"What sort of problem? Ah—is this channel secure?"

Canaba laughed bitterly. "On this planet, nothing is secure. But I don't think I'm being traced. But I can't come up yet. I need . . . help."

"Vaughn, we aren't equipped to break you out against superior forces—if you've become a prisoner—"

He shook his head. "No, it's not that. I've . . . lost something. I need help to get it back."

"I'd understood you were to leave everything. You would be compensated later."

"It's not a personal possession. It's something your employer wants very badly. Certain . . . samples, have been removed from my . . . power. They won't take me without them."

Dr. Canaba took Miles for a mercenary hireling, entrusted with minimum classified information by Barrayaran Security. So. "All I was asked to transport was you and your skills."

"They didn't tell you everything."

The hell they didn't. Barrayar would take you stark naked, and be grateful. What was this?

Canaba met Miles's frown with a mouth set like iron. "I *won't* leave without them. Or the deal's off. And you can whistle for your pay, mercenary."

He meant it. Damn. Miles's eyes narrowed. "This is all a bit mysterious."

Canaba shrugged acknowledgment. "I'm sorry. But I *must* . . . Meet with me, and I'll tell you the rest. Or go, I don't care which. But a certain thing must be accomplished, must be . . . expiated." He trailed off in agitation.

Miles took a deep breath. "Very well. But every complication you add increases your risk. And mine. This had better be worth it."

"Oh, Admiral," breathed Canaba sadly, "it is to me. It is to me."

Snow sifted through the little park where Canaba met them, giving Miles something new to swear at if only he hadn't run out of invective hours ago. He was shivering even in his Dendarii-issue parka by the time Canaba walked past the dingy kiosk where Miles and Bel roosted. They fell in behind him without a word.

Bharaputra Laboratories were headquartered in a downside town Miles frankly found worrisome; guarded shut-

tleport, guarded Syndicate buildings, guarded municipal buildings, guarded walled residential compounds; in between, a crazy disorder of neglected aging structures that didn't seem to be guarded by anyone, occupied by people who *slunk*. It made Miles wonder if the two Dendarii troopers he'd detailed to shadow them were quite enough. But the slithery people gave them a wide berth; they evidently understood what guards meant. At least during daylight.

Canaba led them into one of the nearby buildings. Its lift tubes were out of order, its corridors unheated. A darkly dressed maybe-female person scurried out of their way in the shadows, reminding Miles uncomfortably of a rat. They followed Canaba dubiously up the safety ladder set in the side of a dead lift tube, down another corridor, and through a door with a broken palm-lock into an empty dirty room, greyly lit by an unpolarized but intact window. At least they were out of the wind.

"I think we can talk safely here," said Canaba, turning and pulling off his gloves.

"Bel?" said Miles.

Thorne pulled an assortment of anti-surveillance detectors from its parka and ran a scan, as the two guards prowled the perimeters. One stationed himself in the corridor, the second near the window.

"It scans clean," said Bel at last, as if reluctant to believe its own instruments. "For now." Rather pointedly, Bel walked around Canaba and scanned him too. Canaba waited with bowed head, as if he felt he deserved no better. Bel set up the sonic baffler.

Miles shrugged back his hood and opened his parka, the better to reach his concealed weapons in the event of a trap. He was finding Canaba extraordinarily hard to read. What were the man's motivations anyway? There was no doubt House Bharaputra had assured his comfort—his coat, the rich cut of his clothing beneath it, spoke of that—and though his standard of living surely would not drop when he transferred his allegiance to the Barrayaran Imperial Science Institute, he would not have nearly the opportunities to amass wealth on the side that he had here. But why work for a place like House Bharaputra in the first place unless greed overwhelmed integrity?

"You puzzle me, Dr. Canaba," said Miles lightly. "Why this mid-career switch? I'm pretty well acquainted with your new employers, and frankly, I don't see how they could out-bid House Bharaputra." There, that was a properly mercenary way to put it.

"They offered me protection from House Bharaputra. Although, if *you're* it . . ." he looked doubtfully down at Miles. Ha. And, hell. The man really was ready to bolt. Leaving Miles to explain the failure of his mission to Chief of Imperial Security Illyan in person. "They bought our services," said Miles, "and therefore you command our services. They want you safe and happy. But we can't begin to protect you when you depart from a plan designed to maximize your safety, throw in random factors, and ask us to operate in the dark. I need full knowledge of what's going on if I'm to take full responsibility for the results."

"No one is asking you to take responsibility."

"I beg your pardon, doctor, but they surely have."

"Oh," said Canaba. "I . . . see." He paced to the window, back. "But will you do what I ask?"

"I will do what I can."

"Happy," Canaba snorted. "God . . ." he shook his head wearily, inhaled decisively. "I never came here for the money. I came here because I could do research I couldn't do anywhere else. Not hedged round with outdated legal restrictions. I dreamed of breakthroughs . . . but it became a nightmare. The freedom became slavery. The things they wanted me to do! . . . Constantly interrupting the things *I* wanted to do. Oh, you can always find someone to do anything for money, but they're second-raters. These labs are full of second-raters. The very best can't be bought. I've done things, unique things, that Bharaputra won't develop because the profit would be too small, never mind how many people it would benefit—I get no credit, no standing for my work—every year, I see in the literature of my field galactic honors going to lesser men, because I cannot publish my results. . . . " he stopped, lowered his head. "I doubtless sound like a megolomaniac to you."

"Ah . . . " said Miles, "you sound quite frustrated."

"The frustration," said Canaba, "woke me from a long sleep. Wounded ego—it was only wounded ego. But in my pride, I rediscovered shame. And the weight of it stunned me, stunned me where I stood. *Do* you understand? Does it matter if you understand? Ah!" He paced away to the wall,and stood facing it, his back rigid.

"Uh," Miles scratched the back of his head ruefully, "yeah, I'd be glad to spend many fascinating hours listening to you explain it to me—on my ship. Outbound."

Canaba turned with a crooked smile. "You are a practical man, I perceive. A soldier. Well, God knows I need a soldier now."

"Things are that screwed up, eh?"

"It . . . happened suddenly. I thought I had it under control."

"Go on," sighed Miles.

"There were seven synthesized gene-complexes. One of them is a cure for a certain obscure enzyme disorder. One of them will increase oxygen generation in space station algae twenty-fold. One of them came from outside Bharaputra Labs, brought in by a man—we never found out who he really was, but death followed him. Several of my colleagues who had worked on his project were murdered all in one night, by the commandos who pursued him—their records destroyed—I never told anyone I'd borrowed an unauthorized tissue sample to study. I've not unraveled it fully yet, but I can tell you, it's absolutely unique."

Miles recognized that one, and almost choked, reflecting upon the bizarre chain of circumstances that had placed an identical tissue sample in the hands of Dendarii Intelligence a year ago. Terrence See's telepathy complex—and the main reason *why* His Imperial Majesty suddenly wanted a top geneticist. Dr. Canaba was in for a little surprise when he arrived at his new Barrayaran laboratory. But if the other six complexes came anywhere near matching the value of the known one, Security Chief Illyan would peel Miles with a

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dull knife for letting them slip through his fingers. Miles's attention to Canaba abruptly intensified. This side-trip might not be as trivial as he'd feared.

"Together, these seven complexes represent tens of thousands of hours of research time, mostly mine, some of others—my life's work. I'd planned from the beginning to take them with me. I bundled them up in a viral insert and placed them, bound and dormant, in a live . . . " Canaba faltered, "organism, for storage. An organism, I thought, that no one would think to look at for such a thing."

"Why didn't you just store them in your own tissue?" Miles asked irritably. "Then you couldn't lose 'em."

Canaba's mouth opened. "I . . . never thought of that. How elegant. Why didn't I think of that?" His hand touched his forehead wonderingly, as if probing for systems failure. His lips tightened again. "But it would have made no difference. I would still need to . . . " he fell silent. "It's about the organism," he said at last. "The . . . creature." Another long silence.

"Of all things I did," Canaba continued lowly, "of all the interruptions this vile place imposed on me, there is one I regret the most. You understand, this was years ago. I was younger, I thought I still had a future here to protect. And it wasn't all my doing—guilt by committee, eh? Spread it around, make it easy, say it was *his* fault, *her* doing. . . . well, it's mine now."

You mean it's *mine* now, thought Miles grimly. "Doctor, the more time we spend here, the greater the chance of compromising this operation. Please get to the point."

"Yes . . . yes. Well, a number of years ago, House Bharaputra Laboratories took on a contract to manufacture a . . . new species. Made to order."

"I thought it was House Ryoval that was famous for making people, or whatever, to order," said Miles.

"They make slaves, one-off. They are very specialized. And small—their customer base is surprisingly small. There are many rich men, and there are, I suppose, many depraved men, but a House Ryoval customer has to be a member of both sets, and the overlap isn't as large as you'd think. Anyway, our contract was supposed to lead to a major production run, far beyond Ryoval's capabilities. A certain subplanetary government, hard-pressed by its neighbors, wanted us to engineer a race of super-soldiers for them."

"What, again?" said Miles. "I thought that had been tried. More than once."

"This time, we thought we could do it. Or at least, the Bharaputra hierarchy was willing to take their money. But the project suffered from too much input. The client, our own higher-ups, the genetics project members, everybody had ideas they were pushing. I swear it was doomed before it ever got out of the design committee."

"A super-soldier. Designed by a committee. Ye gods. The mind boggles." Miles's eyes were wide in fascination. "So then what happened?"

"It seemed to . . . several of us, that the physical limits of the merely human had already been reached. Once a, say, muscle system has been brought to perfect health, stimulated with maximum

hormones, exercised to a certain limit, that's all you can do. So we turned to other species for special improvements. I, for instance, became fascinated by the aerobic and anaerobic metabolism in the muscles of the thoroughbred horse—"

"What?" said Thorne, shocked.

"There were other ideas. Too many. I swear, they weren't all mine."

"You mixed human and animal genes?" breathed Miles.

"Why not? Human genes have been spliced into animals from the crude beginnings—it was almost the first thing tried. Human insulin from bacteria and the like. But till now, none dared do it in reverse. I broke the barrier, cracked the codes. . . . It looked good at first. It was only when the first ones reached puberty that all the errors became fully apparent. Well, it was only the initial trial. They were meant to be formidible. But they ended up monstrous."

"Tell me," Miles choked, "were there any actual combat-experienced soldiers on the committee?"

"I assume the client had them. They supplied the parameters." said Canaba.

Said Thorne in a suffused voice, "*I* see. They were trying to reinvent the *enlisted* man."

Miles shot Thorne a quelling glower, and tapped his chrono. "Don't let us interrupt, doctor."

There was a short silence. Canaba began again. "We ran off ten prototypes. Then the client . . . went out of business. They lost their war—"

"Why am I not surprised?" Miles muttered under his breath.

"—funding was cut off, the project was dropped before we could apply what we had learned from our mistakes. Of the ten prototypes, nine have since died. There was one left. We were keeping it at the labs due to . . . difficulties, in boarding it out. I placed my gene complexes in it. They are there still. The last thing I meant to do before I left was kill it. A mercy . . . a responsibility. My expiation, if you will."

"And then?" prodded Miles.

"A few days ago, it was suddenly sold to House Ryoval. As a novelty, apparently. Baron Ryoval collects oddities of all sorts, for his tissue banks—"

Miles and Bel exchanged a look.

"—I had no idea it was to be sold. I came in in the morning and it was gone. I don't think Ryoval has any idea of its real value. It's there now, as far as I know, at Ryoval's facilities."

Miles decided he was getting a sinus headache. From the cold, no doubt. "And what, pray, d'you want us soldiers to do about it?"

"Get in there, somehow. Kill it. Collect a tissue sample. Only then will I go with you."

And stomach twinges. "What, both ears and the tail?"

Canaba gave Miles a cold look. "The left gastrocnemius muscle. That's where I injected my complexes. These storage viruses aren't virulent, they won't have migrated far. The greatest concentration should still be there."

"I see." Miles rubbed his temples, and pressed his eyes. "All right. We'll take care of it. This personal contact between us is very dangerous, and I'd rather not repeat it. Plan to report to my ship in forty-eight hours. Will we have any trouble recognizing your critter?"

"I don't think so. This particular specimen topped out at just over eight

feet. I . . . want you to know, the fangs were *not* my idea."

"I . . . see."

"It can move very fast, if it's still in good health. Is there any help I can give you? I have access to painless poisons—"

"You've done enough, thank you. Please leave it to us professionals, eh?"

"It would be best if its body can be destroyed entirely. No cells remaining. If you can."

"That's why plasma arcs were invented. You'd best be on your way."

"Yes." Canaba hesitated. "Admiral Naismith?"

"Yes . . ."

"I . . . it might also be best if my future employer didn't learn about this. They have intense military interests. It might excite them unduly."

"Oh," said Miles/Admiral Naismith/Lieutenant Lord Vorkosigan of the Barrayaran Imperial Service, "I don't think you have to worry about that."

"Is forty-eight hours enough for your commando raid?" Canaba worried. "You understand, if you don't get the tissue, I'll go right back downside. I will not be trapped aboard your ship."

"You will be happy. It's in my contract," said Miles. "Now you'd better get gone."

"I must rely on you, sir." Canaba nodded in suppressed anguish, and withdrew.

They waited a few minutes in the cold room, to let Canaba put some distance between them. The building creaked in the wind; from an upper corridor echoed an odd shriek, and later, a laugh abruptly cut off. The guard shadowing Canaba returned. "He made it to his ground car all right, sir."

"Well," said Thorne, "I suppose we'll need to get hold of a plan of Ryoval's facilities, first—"

"I think not," said Miles.

"If we're to raid—"

"Raid, hell. I'm not risking my men on anything so idiotic. I said I'd slay his sin for him. I didn't say how."

The commercial comconsole net at the downside shuttleport seemed as convenient as anything. Miles slid into the booth and fed the machine his credit card while Thorne lurked just outside the viewing angle and the guards, outside, guarded. He encoded the call.

In a moment, the vid plate produced the image of a sweet-faced receptionist with dimples and a white fur crest instead of hair. "House Ryoval, Customer Services. How may I help you, sir?"

"I'd like to speak to Manager Deem, in Sales and Demonstrations," said Miles smoothly, "about a possible purchase for my organization."

"Who may I say is calling?"

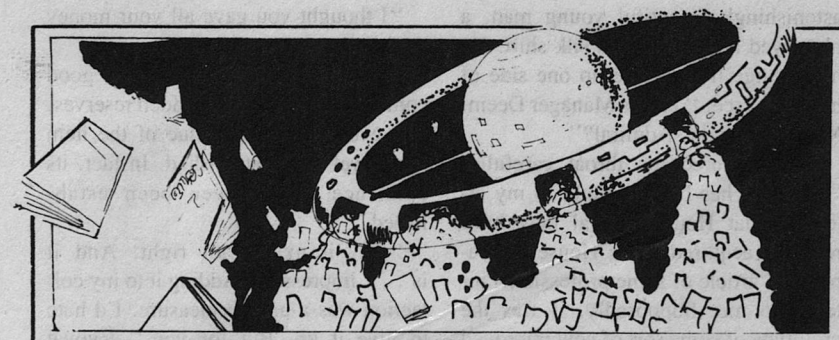
"Admiral Miles Naismith, Dendarii Free Mercenary Fleet."

"One moment, sir."

"You really think they'll just sell it?" Bel muttered from the side as the girl's face was replaced by a flowing pattern of colored lights and some syrupy music.

"Remember what we overheard yesterday?" said Miles. "I'm betting it's *on* sale. Cheap." He must try not to look too interested.

In a remarkably short time, the colored glop gave way to the face of an



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astonishingly beautiful young man, a blue-eyed albino in a red silk shirt. He had a huge livid bruise up one side of his white face. "This is Manager Deem. May I help you, Admiral?"

Miles cleared his throat carefully. "A rumor has been brought to my attention that House Ryoval may have recently acquired from House Bharaputra an article of some professional interest to me. Supposedly, it was the prototype of some sort of new improved fighting man. Do you know anything about it?"

Deem's hand stole to his bruise and palpated it gently, then twitched away. "Indeed, sir, we do have such an article."

"Is it for sale?"

"Oh, *ye*—I mean, I think some arrangement is pending. But it may still be possible to bid on it."

"Would it be possible for me to inspect it?"

"Of course," said Deem with suppressed eagerness. "How soon?"

There was a burst of static, and the vid image split, Deem's face abruptly shrinking to one side. The new face was only too familiar. Bel hissed under its breath.

"I'll take this call, Deem," said Baron Ryoval.

"Yes, my lord." Deem's eyes widened in surprise, and he cut out. Ryoval's image swelled to occupy the space available.

"So, Betan," Ryoval smiled, "it appears I have something you want after all."

Miles shrugged. "Maybe," he said neutrally. "If it's in my price range."

"I thought you gave all your money to Fell."

Miles spread his hands. "A good commander always has hidden reserves. However, the actual value of the item hasn't yet been established. In fact, its existence hasn't even been established."

"Oh, it exists, all right. And it is . . . impressive. Adding it to my collection was a unique pleasure. I'd hate to give it up. But for you," Ryoval smiled more broadly, "it may be possible to arrange a special cut rate." He chuckled, as at some secret pun that escaped Miles.

A special cut throat is more like it. "Oh?"

"I propose a simple trade," said Ryoval. "Flesh for flesh."

"You may overestimate my interest, Baron."

Ryoval's eyes glinted. "I don't think so."

He knows I wouldn't touch him with a stick if it weren't something pretty compelling. So. "Name your proposal, then."

"I'll trade you even, Bharaputra's pet monster—ah, you should see it, Admiral—for three tissue samples. Three tissue samples that will, if you are clever about it, cost you nothing." Ryoval held up one finger. "One from your Betan hermaphrodite," a second finger, "one from yourself," a third finger, making a W, "and one from Baron Fell's quaddie musician."

Over in the corner, Bel Thorne appeared to be suppressing an apoplectic fit. Quietly, fortunately.

"That third could prove extremely

difficult to obtain," said Miles, buying time to think.

"Less difficult for you than me," said Ryoval. "Fell knows my agents. My overtures have put him on guard. You represent a unique opportunity to get in under that guard. Given sufficient motivation, I'm certain it's not beyond you, mercenary."

"Given sufficient motivation, very little is beyond me, Baron," said Miles semi-randomly.

"Well, then. I shall expect to hear from you within—say—twenty-four hours. After that time my offer will be withdrawn." Ryoval nodded cheerfully. "Good day, Admiral." The vid blanked.

"Well, then," echoed Miles.

"Well what?" said Thorne with suspicion. "You're not actually seriously considering that—vile proposal, are you?"

"What does he want my tissue sample for, for God's sake?" Miles wondered aloud.

"For his dog and dwarf act, no doubt," said Thorne nastily.

"Now, now. He'd be dreadfully disappointed when my clone turned out to be six feet tall, I'm afraid." Miles cleared his throat. "It wouldn't actually hurt anyone, I suppose. To take a small tissue sample. Whereas a commando raid risks lives."

Bel leaned back against the wall and crossed its arms. "Not true. You'd have to fight me for mine. And *hers*."

Miles grinned sourly. "So."

"So?"

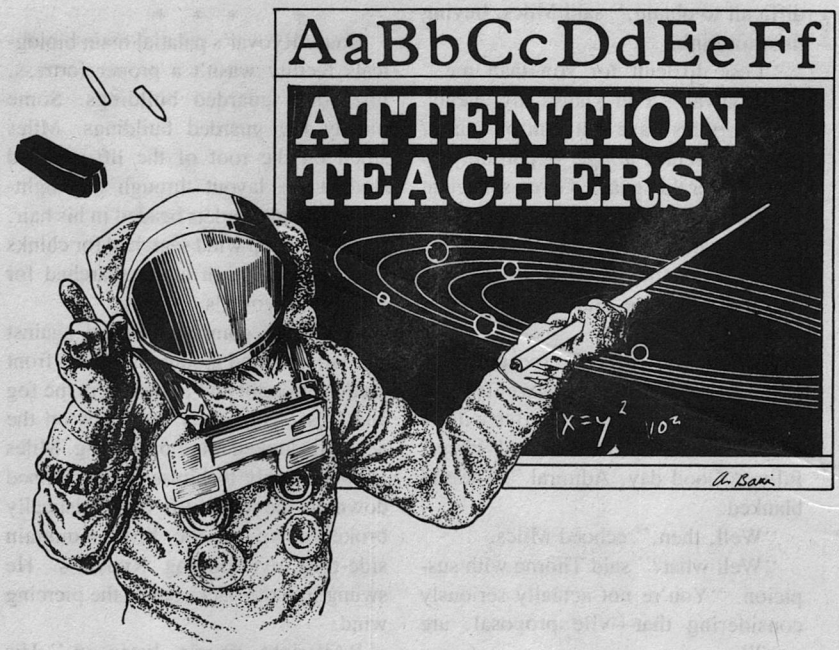
"So let's go find a map of Ryoval's flesh pit. It seems we're going hunting."

* * *

House Ryoval's palatial main biologicals facility wasn't a proper fortress, just some guarded buildings. Some bloody big guarded buildings. Miles stood on the roof of the lift-van and studied the layout through his night-glasses. Fog droplets beaded in his hair. The cold damp wind searched for chinks in his jacket much as he searched for chinks in Ryoval's security.

The white complex loomed against the dark forested mountainside, its front gardens floodlit and fairy-like in the fog and frost. The utility entrances on the near side looked more promising. Miles nodded slowly to himself and climbed down off the rented lift-van, artistically broken-down on the little mountain side-trail overlooking Ryoval's. He swung into the back, out of the piercing wind.

"All right, people, listen up." His squad hunkered around as he set up the holovid map in the middle. The colored lights of the display sheened their faces: tall Ensign Murka, Thorne's second-in-command, and two big troopers. Sergeant Laureen Anderson was the van driver, assigned to outside back-up along with Trooper Sandy Hereld and Captain Thorne. Miles harbored a secret Barrayaran prejudice against taking female troops inside Ryoval's that he trusted he concealed. It went double for Bel Thorne. Not that one's sex would necessarily make any difference to the adventures that might follow in the event of capture, if even a tenth of the bizarre rumors he'd heard were true. Nevertheless . . . Laureen claimed to be able to fly any vehicle made by man through the eye of a needle, not that



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AFF 1

Miles figured she'd ever done anything so domestic as thread a needle in her life. She would not question her assignment.

"Our main problem remains, that we still don't know where exactly in this facility Bharaputra's creature is being kept. So first we penetrate the fence, the outer courts, and the main building, here and here." A red thread of light traced their projected route at Miles's touch on the control board. "Then we quietly pick up an inside employee and fast-penta him. From that point on we're racing time, since we must assume he'll be promptly missed.

"The key word is quietly. We didn't come here to kill *people*, and we are not at war with Ryoval's employees. You carry your stunners, and keep those plasma arcs and the rest of the toys packed till we locate our quarry. We dispatch it fast and quietly, I get my sample," his hand touched his jacket, beneath which rested the collection case that would keep the tissue alive till they got back to the *Ariel*. "Then we fly. If anything goes wrong before I get that very expensive cut of meat, we don't bother to fight our way out. Not worth it. They have peculiar summary ways of dealing with murder charges here, and I don't see the need for any of us to end up as spare parts in Ryoval's tissue banks. We wait for Captain Thorne to arrange a ransom, and then try something else. We hold a lever or two on Ryoval in case of emergencies."

"*Dire* emergencies," Bel muttered.

"If anything goes wrong after the butcher-mission is accomplished, it's back to combat rules. That sample will then be irreplaceble, and must be got back to Captain Thorne at all costs. Laureen, you sure of our emergency pick-up spot?"

"Yes, sir." She pointed on the vid display.

"Everybody else got that? Any questions? Suggestions? Last-minute observations? Communications check, then, Captain Thorne."

Their wrist comms all appeared to be in good working order. Ensign Murka shrugged on the weapons pack. Miles carefully pocketed the blueprint map cube, that had cost them a near-ransom from a certain pliable construction company just a few hours ago. The four members of the penetration team slipped from the van and merged with the frosty darkness.

They slunk off through the woods. The frozen crunchy layer of plant detritus tended to slide underfoot, exposing a layer of slick mud. Murka spotted a spy eye before it spotted them, and blinded it with a brief burst of microwave static while they scurried past. The useful big guys made short work of boosting Miles over the wall. Miles tried not to think about the ancient pub sport of dwarf tossing. The inner court was stark and utilitarian, loading docks with big locked doors, rubbish collection bays, and a few parked vehicles.

Footsteps echoed, and they ducked down in a rubbish bay. A red-clad guard passed, slowly waving an infra-red scanner. They crouched and hid their faces in their infra-red blank ponchos, looking like so many bags of garbage, no doubt. Then it was tiptoe up to the loading docks.

Ducts. The key to Ryoval's facility had turned out to be ducts—for heating,

for access to power-optics cables, for the comm system. Narrow ducts. Quite impassable to a big guy. Miles slipped out of his poncho and gave it to a trooper to fold and pack.

Miles balanced on Murka's shoulders and cut his way through the first ductlet, a ventilation grille high on the wall above the loading dock doors. Miles handed the grille down silently, and after a quick visual scan for unwanted company, slithered through. It was a tight fit even for him. He let himself down gently to the concrete floor, found the door control box, shorted the alarm, and raised the door about a meter. His team rolled through, and he let the door back down as quietly as he could. So far so good; they hadn't yet had to exchange a word.

They made it to cover on the far side of the receiving bay just before a red-coveralled employee wandered through, driving an electric cart loaded with cleaning robots. Murka touched Miles's sleeve, and looked his inquiry—*This one?* Miles shook his head, *Not yet.* A maintenance man seemed less likely than an employee from the inner sanctum to know where their quarry was kept, and they didn't have time to litter the place with the unconscious bodies of false trials. They found the tunnel to the main building, just as the map cube promised. The door at the end was locked, as expected.

It was up on Murka's shoulders again. A quick zizz of Miles's cutters loosened a panel in the ceiling, and he crawled through—the frail supporting framework would surely not have held a man of greater weight—and found the power cables running to the door lock. He was just looking over the problem and pulling tools out of his pocketed uniform jacket when Murka's hand reached up to thrust the weapons pack beside him and quietly pull the panel back into place. Miles flung himself to his belly and pressed his eye to the crack as a voice from down the corridor bellowed, "Freeze!"

Swear words screamed through Miles's head. He clamped his jaw on them. He looked down on the tops of his troopers' heads. In a moment, they were surrounded by half a dozen red-clad, black-trousered armed guards. "What are you doing here?" snarled the guard sergeant.

"Oh, shit!" cried Murka. "*Please,* mister, don't tell my CO you caught us in here. He'd bust me back to private!"

"Huh?" said the guard sergeant. He prodded Murka with his weapon, a lethal nerve disruptor. "Hands up! Who are you?"

"M'name's Murka. We came in on a mercenary ship to Fell Station, but the captain wouldn't grant us downside passes. Think of it—we come all the way to Jackson's Whole, and the son-ofabitch wouldn't let us go downside! Bloody pure-dick wouldn't let us see Ryoval's!"

The red-tunic'd guards were doing a fast scan-and-search, none too gently, and finding only stunners and the portion of security-penetration devices that Murka had carried.

"I made a bet we could get in even if we couldn't afford the front door." Murka's mouth turned down in great discouragement. "Looks like I lost."

"Looks like you did," growled the guard sergeant, drawing back.

One of his men held up the thin collection of baubles they'd stripped off the Dendarii. "They're not equipped like an assassination team," he observed.

Murka drew himself up, looking wonderfully offended. "We aren't!"

The guard sergeant turned over a stunner. "AWOL, are you?"

"Not if we make it back before midnight." Murka's tone went wheedling. "Look, m' CO's a right bastard. Suppose there's any way you could see your way clear that he doesn't find out about this?" One of Murka's hands drifted suggestively past his wallet pocket.

The guard sergeant looked him up and down, smirking. "Maybe."

Miles listened with open-mouthed delight. *Murka, if this works I'm promoting you. . . .*

Murka paused. "Any chance of seeing inside first? Not the girls even, just the place? So I could say that I'd seen it."

"This isn't a whorehouse, soldier boy!" snapped the guard sergeant.

Murka looked stunned. "What?"

"This is the *biologicals* facility."

"Oh," said Murka.

"You *idiot*," one of the troopers put in on cue. Miles sprinkled silent blessings down upon his head. None of the three so much as flicked an eyeball upward.

"But the man in town told me—" began Murka.

"What man?" said the guard sergeant.

"The man who took m'money," said Murka.

A couple of the red-tunic'd guards were beginning to grin. The guard sergeant prodded Murka with his nerve disruptor. "Get along, soldier boy. Back that way. This is your lucky day."

"You mean we get to see inside?" said Murka hopefully.

"No," said the guard sergeant, "I mean we aren't going to break both your legs before we throw you out on your ass." He paused and added more kindly, "There's a whorehouse back in town." He slipped Murka's wallet out of his pocket, checked the name on the credit card and put it back, and removed all the loose currency. The guards did the same to the outraged-looking troopers, dividing the assorted cash up among them. "They take credit cards, and you've still got till midnight. Now move!"

And so Miles's squad was chivvied, ignominiously but intact, down the tunnel. Miles waited till the whole mob was well out of earshot before keying his wristcom. "Bel?"

"Yes," came back the instant reply.

"Trouble. Murka and the troops were just picked up by Ryoval's security. I believe the boy genius has just managed to bullshit them into throwing them out the back door, instead of rendering them down for parts. I'll follow as soon as I can, we'll rendezvous and regroup for another try." Miles paused. This was a total bust, they were now worse off than when they started. Ryoval's security would be stirred up for the rest of the long Jacksonian night. He added to the comm, "I'm going to see if I can't at least find out the location of the critter before I withdraw. Should improve our chances of success next round."

Bel swore in a heartfelt tone. "Be careful."

"You bet. Watch for Murka and the boys. Naismith out."

Once he'd identified the right cables it was the work of a moment to make the door slide open. He then had an interesting dangle by his fingertips while coaxing the ceiling panel to fall back into place before he dropped from maximum downward extension, fearful for his bones. Nothing broke. He slipped across the portal to the main building and took to the ducts as soon as possible, the corridors having been proved dangerous. He lay on his back in the narrow tube and balanced the blueprint holocube on his belly, picking out a new and safer route not necessarily passable to a couple of husky troopers. And where did one look for a monster? A closet?

It was at about the third turn, inching his way through the system dragging the weapons pack, that he became aware that the territory no longer matched the map. Hell and damnation. Were these changes in the system since its construction, or a subtly sabotaged map? Well, no matter, he wasn't really lost, he could still retrace his route.

He crawled along for about thirty minutes, discovering and disarming two alarm sensors before they discovered him. The time factor was getting seriously pressing. Soon he would have to—ah, there! He peered through a vent grille into a dim room filled with holovid and communications equipment. *Small Repairs*, the map cube named it. It didn't look like a repairs shop. Another change since Ryoval had moved in? But a man sat alone with his back to Miles's wall. Perfect, too good to pass up.

Breathing silently, moving slowly, Miles eased his dart-gun out of the pack and made sure he loaded it with the right cartridge, fast-penta spiked with a paralyzer, a lovely cocktail blended for the purpose by the *Ariel's* medtech. He sighted through the grille, aimed the needle-nose of the dart gun with tense precision, and fired. Bull's-eye. The man slapped the back of his neck once and sat still, hand falling nervelessly to his side. Miles grinned briefly, cut his way through the grille, and lowered himself to the floor.

The man was well dressed in civilian-type clothes—one of the scientists, perhaps? He lolled in his chair, a little smile playing around his lips, and stared with unalarmed interest at Miles. He started to fall over.

Miles caught him and propped him back upright. "Sit up now, that's right, you can't talk with your face in the carpet now, can you?"

"Nooo . . . " the man bobbled his head and smiled agreeably.

"Do you know anything about a genetic construct, a monstrous creature, just recently bought from House Bharaputra and brought to this facility?"

The man blinked and smiled. "Yes."

Fast-penta subjects did tend to be literal, Miles reminded himself. "Where is it being kept?"

"Downstairs."

"Where exactly downstairs?"

"In the sub-basement. The crawlspace around the foundations. We were hoping it would catch some of the rats, you see." The man giggled. "Do cats eats rats? Do rats eat cats? . . ."

Miles checked his map-cube. Yes. That looked good, in terms of the penetration team getting in and out, though it was still a large search area, broken

up into a maze by structual elements running down into the bedrock, and specially set low-vibration support columns running up into the laboratories. At the lower edge, where the mountainside sloped away, the space ran high-ceilinged and very near the surface, a possible break-out point. The space thinned to head-cracking narrowness and then to bedrock at the back where the building wedged into the slope. All right. Miles opened his dart case to find something that would lay his victim out cold and non-questionable for the rest of the night. The man pawed at him and his sleeve slipped back to reveal a wrist-comm almost as thick and complex as Miles's own. A light blinked on it. Miles looked at the device, suddenly uneasy. This room . . . "By the way, who are you?"

"Moglia, Chief of Security, Ryoval Biologicals," the man recited happily. "At your service, sir."

"Oh, indeed you are." Miles's suddenly-thick fingers scrabbled faster in his dart case. Damn, damn, *damn*.

The door burst open. "Freeze, mister!"

Miles hit the tight-beam alarm/self-destruct on his own wrist comm and flung his hands up, and the wrist comm off, in one swift motion. Not by chance, Moglia sat between Miles and the door, inhibiting the trigger reflexes of the entering guards. The comm melted as it arced through the air—no chance of Ryoval security tracing the outside squad through it now, and Bel would at least know something had gone wrong.

The security chief chuckled to himself, temporarily fascinated by the task of counting his own fingers. The red-clad guard sergeant, backed by his squad, thundered into what was now screamingly obvious to Miles as the Security Operations room, to jerk Miles around, slam him face-first into the wall, and begin frisking him with vicious efficiency. Within moments he had separated Miles from a clanking pile of incriminating equipment, his jacket, boots, and belt. Miles clutched the wall and shivered with the pain of several expertly-applied nerve jabs and the swift reversal of his fortune.

The security chief, when un-penta'd at last, was not at all pleased with the guard sergeant's confession about the three uniformed men he had let go with a fine earlier in the evening. He put the whole guard shift on full alert, and sent an armed squad out to try and trace the escaped Dendarii. Then, with an apprehensive expression on his face very like the guard sergeant's during his mortified admission—compounded with sour satisfaction, contemplating Miles, and drug-induced nausea—he made a vid call.

"My lord?" said the security chief carefully.

"What is it, Moglia?" Baron Ryoval's face was sleepy and irritated.

"Sorry to disturb you sir, but I thought you might like to know about the intruder we just caught here. Not an ordinary thief, judging from his clothes and equipment. Strange-looking fellow, sort of a tall dwarf. He squeezed in through the ducts." Moglia held up tissue-collection kit, chip-driven alarm-disarming tools, and Miles's weapons, by way of evidence. The guard sergeant bundled Miles, stumbling, into range of the vid's pick-up. "He was asking a lot

of questions about Bharaputra's monster."

Ryoval's lips parted. Then his eyes lit, and he threw back his head and laughed. "I should have guessed. Stealing when you should be buying, Admiral?" he chortled. "Oh, very good, Moglia!"

The security chief looked fractionally less nervous. "Do you know this little mutant, my lord?"

"Yes, indeed. He calls himself Miles Naismith. A mercenary—bills himself as an admiral. Self-promoted, no doubt. Excellent work, Moglia. Hold him, and I'll be there in the morning and deal with him personally."

"Hold him how, sir?"

Ryoval shrugged. "Amuse yourselves. Freely."

When Ryoval's image faded, Miles found himself pinned between the speculative glowers of both the security chief and the guard sergeant.

Just to relieve feelings, a burly guard held Miles while the security chief delivered a blow to his belly. But the chief was still too ill to really enjoy this as he should. "Came to see Bharaputra's toy soldier, did you?" he gasped, rubbing his own stomach.

The guard sergeant caught his chief's eye. "You know, I think we should give him his wish."

The security chief smothered a belch, and smiled as at a beatific vision. "Yes . . . "

Miles, praying they wouldn't break his arms, found himself being frog-marched down a complex of corridors and lift-tubes by the burly guard, followed by the sergeant and the chief. They took a fast lift-tube to the very bottom, a dusty basement crowded with stored and discarded equipment and supplies. They made their way to a locked hatch set in the floor. It swung open on a metal ladder descending into obscurity.

"The last thing we threw down there was a rat," the guard sergeant informed Miles cordially. "Nine bit its head right off. Nine gets very hungry. Got a metabolism like an ore furnace."

The guard forced Miles onto the ladder and down it a meter or so by the simple expedient of striking at his clinging hands with a truncheon. Miles hung just out of range of the stick, eyeing the dimly-lit stone below. The rest was pillars and shadows and a cold dankness.

"Nine!" called the guard sergeant into the echoing darkness. "Nine! Dinner! Come and catch it!"

The security chief laughed mockingly, then clutched his head and groaned under his breath.

Ryoval had said he'd deal with Miles personally in the morning; surely the guards understood their boss wanted a live prisoner. Didn't they? "Is this the dungeon?" Miles spat blood and peered around.

"No, no, just a basement," the guard sergeant assured him cheerily. "The dungeon is for the *paying* customers. Heh, heh, heh." Still chortling at his own humor, he kicked the hatch closed. The chink of the locking mechanism rained down; then silence.

The bars of the ladder bit chill through Miles's socks. He hooked an arm around an upright and tucked one hand into the armpit of his black T-shirt to warm it briefly. His grey trousers had been emp-

tied of everything but a ration bar, his handkerchief, and his legs.

He clung there for a long time. Going up was futile; going down, singularly uninviting. Eventually the startling ganglionic pain began to dull, and the shaking physical shock to wear off. Still he clung. Cold.

It could have been worse, Miles reflected. The sergeant and his squad could have decided they wanted to play Lawrence of Arabia and the Six Turks. Commodore Tung, Miles's Dendarii chief of staff and a certified military history nut, had been plying Miles with a series of classic military memoirs lately. How had Colonel Lawrence escaped an analogous tight spot? Ah, yes, played dumb and persuaded his captors to throw him out in the mud. Tung must have pressed that book-fax on Murka, too.

The darkness, Miles discovered as his eyes adjusted, was only relative. Faint luminescent panels in the ceiling here and there shed a sickly yellow glow. He descended the last two meters to stand on solid rock.

He pictured the newsfax, back home on Barrayar—*Body of Imperial Officer Found in Flesh-Czar's Dream Palace. Death From Exhaustion?* Dammit, this wasn't the glorious sacrifice in the Emperor's service he'd once vowed to risk, this was just embarassing. Maybe Bharaputra's creature would eat the evidence.

With this morose comfort in mind, he began to limp from pillar to pillar, pausing, listening, looking around. Maybe there was another ladder somewhere. Maybe there was a hatch someone had forgotten to lock. Maybe there was still hope.

Maybe there was something moving in the shadows just beyond that pillar. . . .

Miles's breath froze, then eased again, as the movement materialized into a fat albino rat the size of an armadillo. It shied as it saw him and waddled rapidly away, its claws clicking on the rock. Only an escaped lab rat. A bloody big rat, but still, only a rat.

The huge rippling shadow struck out of nowhere, at incredible speed. It grabbed the rat by its tail and swung it squealing against a pillar, dashing out its brains with a crunch. A flash of a thick claw-like fingernail, and the white furry body was ripped open from sternum to tail. Frantic fingers peeled the skin away from the rat's body as blood splattered. Miles first saw the fangs as they bit and tore and buried themselves in the rat's tissues.

They were functional fangs, not just decorative, set in a protruding jaw, with long lips and a wide mouth; yet the total effect was lupine rather than simian. A flat nose, ridged, powerful brows, high cheekbones. Hair a dark matted mess. And yes, fully eight feet tall, a rangy, tense-muscled body.

Climbing back up the ladder would do no good, the creature could pluck him right off and swing him just like the rat. Levitate up the side of a pillar? Oh, for suction-cup fingers and toes, something the bioengineering committee had missed somehow. Freeze and play invisible? Miles settled on this last defense by default—he was paralyzed with terror.

The big feet, bare on the cold rock,

also had claw-like toenails. But the creature was dressed, in clothes made of green lab-cloth, a belted kimono-like coat and loose trousers. And one other thing.

They didn't tell me it was female.

She was almost finished with the rat when she looked up and saw Miles. Bloody-faced, bloody-handed, she froze as still as he.

In a spastic motion, Miles whipped the squashed ration bar from his trouser thigh-pocket and extended it toward her in his outstretched hand. "Dessert?" he smiled hysterically.

Dropping the rat's stripped carcass, she snatched the bar out of his hand, ripped off the cover, and devoured it in four bites. Then she stepped forward, grabbed him by an arm and his black T-shirt, and lifted him up to her face. Her breath was about what he would have guessed. Her eyes were raw and burning. "Water!" she croaked.

They didn't tell me she talked.

"Um, um—water," squeaked Miles. "Quite. There ought to be water around here—look, up at the ceiling, all those pipes. If you'll, um, put me down, good girl, I'll try and spot a water pipe or something . . . "

Slowly, she lowered him back to his feet and released him. He backed carefully away, his hands held out open at his sides. He cleared his throat, and tried to bring his voice back down to a low, soothing tone. "Let's try over here. The ceiling gets lower, or rather, the bedrock rises . . . over near that light panel, there, that thin composite plastic tube—white's the usual color-code for water. We don't want grey, that's sewage, or red, that's the power-optics . . . " No telling what she understood, tone was everything with creatures. "If you, uh, could hold me up on your shoulders like Ensign Murka, I could have a go at loosening that joint there . . . " he made pantomime gestures, uncertain if anything was getting through to whatever intelligence lay behind those terrible eyes.

The bloody hands, easily twice the size of his own, grabbed him abruptly by the hips and boosted him upward. He clutched the white pipe, inched along it to a screw-joint. Her thick shoulders beneath his feet moved along under him. Her muscles trembled, it wasn't all his own shaking. The joint was tight—he needed tools—he turned with all his strength, in danger of snapping his fragile finger bones. Suddenly the joint squeaked and slid. It gave, the plastic collar was moving, water began to spray between his fingers. One more turn and it sheared apart, and water arced in a bright stream down onto the rock beneath.

She almost dropped him in her haste. She put her mouth under the stream, wide open, let the water splash straight in and all over her face, coughing and guzzling even more frantically than she'd gone at the rat. She drank, and drank, and drank. She let it run over her hands, her face and head, washing away the blood, and then drank some more. Miles began to think she'd never quit, but at last she backed away and pushed her wet hair out of her eyes, and stared down at him. She stared at him for what seemed like a full minute, then suddenly roared, "Cold!"

Miles jumped. "Ah . . . cold . . . right. Me too, my socks are wet. Heat,

you want heat. Lessee. Uh, let's try back this way, where the ceiling's lower. No point here, the heat would all collect up there out of reach, no good . . . " She followed him with all the intensity of a cat tracking a . . . well . . . rat, as he skittered around pillars to where the crawl space's floor rose to genuine crawl-height, about four feet. There, that one, that was the lowest pipe he could find. "If we could get this open," he pointed to a plastic pipe about as big around as his waist, "it's full of hot air being pumped along under pressure. No handy joints though, this time." He stared at his puzzle, trying to think. This composite plastic was extremely strong.

She crouched and pulled, then lay on her back and kicked up at it, then looked at him quite woefully.

"Try this." Nervously, he took her hand and guided it to the pipe, and traced long scratches around the circumference with her hard nails. She scratched and scratched, then looked at him again as if to say, *This isn't working!*

"Try kicking and pulling again now," he suggested.

She must have weighed three hundred pounds, and she put it all behind the next effort, kicking then grabbing the pipe, planting her feet on the ceiling and arching with all her strength. The pipe split along the scratches. She fell with it to the floor, and hot air began to hiss out. She held her hands, her face to it, nearly wrapped herself around it, sat on her knees and let it blow across her. Miles crouched down and stripped off his socks and flopped them over the warm pipe to dry. Now would be a good opportunity to run, if only there were anywhere to run to. But he was reluctant to let his prey out of his sight. His prey? He considered the incalculable value of her left calf muscle, as she sat on the rock and buried her face in her knees.

They didn't tell me she wept.

He pulled out his regulation handkerchief, an archaic square of cloth. He'd never understood the rationale for the idiotic handkerchief, except, perhaps, that where soldiers went there would be weeping. He handed it to her. "Here. Mop your eyes with this."

She took it, and blew her big flat nose in it, and made to hand it back.

"Keep it," Miles said. "Uh . . . what do they call you, I wonder?"

"Nine," she growled. Not hostile, it was just the way her strained voice came out of that big throat. " . . . What do they call you?"

Good God, a complete sentence. Miles blinked. "Admiral Miles Naismith." He arranged himself cross-legged.

She looked up, transfixed. "A soldier? A *real officer?*" And then more doubtfully, as if seeing him in detail for the first time, "You?"

Miles cleared his throat firmly. "Quite real. A bit down on my luck just at the moment," he admitted.

"Me, too," she said glumly, and sniffled. "I don't know how long I've been in this basement, but that was my first drink."

"Three days, I think," said Miles. "Have they not, ah, given you any food, either?"

"No." She frowned; the effect, with the fangs, was quite overpowering. "This is worse than anything they did to me in the lab, and I thought that was bad."

It's not what you don't know that'll hurt you, the old saying went. *It's what you do know that isn't so.* Miles thought of his map cube; Miles looked at Nine. Miles pictured himself taking this entire mission's carefully-worked-out strategy plan delicately between thumb and forefinger and flushing it down a waste-disposal unit. The ductwork in the ceiling niggled at his imagination. Nine would never fit through it. . . .

She clawed her wild hair away from her face and stared at him with renewed fierceness. Her eyes were a strange light hazel, adding to the wolfish effect. "What are you *really* doing here? Is this another test?"

"No, this is real life." Miles's lips twitched. "I, ah, made a mistake."

"Guess I did, too," she said, lowering her head.

Miles pulled at his lip and studied her through narrowed eyes. "What sort of life have you had, I wonder?" he mused, half to himself.

She answered literally. "I lived with hired fosterers till I was eight. Like the clones do. Then I started to get big and clumsy and break things—they brought me to live at the lab after that. It was all right, I was warm and had plenty to eat."

"They can't have simplified you too much if they seriously intended you to be a soldier. I wonder what your IQ is?" he speculated.

"One hundred and thirty-five."

Miles fought off stunned paralysis. "I . . . see. Did you ever get . . . any training?"

She shrugged. "I took a lot of tests. They were . . . OK. Except for the aggression experiments. I don't like electric shocks." She brooded a moment. "I don't like experimental psychologists, either. They lie a lot." Her shoulders slumped. "Anyway, I failed. We all failed."

"How can they know you failed if you never had any proper training?" Miles said scornfully. "Soldiering entails some of the most complex, cooperative learned behavior ever invented —I've been studying strategy and tactics for years, and I don't know half yet. It's all up *here.*" He pressed his hands urgently to his head.

She looked across at him sharply. "If that's so," she turned her huge clawed hands over, staring at them, "then why did they do *this* to me?"

Miles stopped short. His throat was strangely dry. *So, admirals lie too. Sometimes, even to themselves.* After an unsettled pause he asked, "Did you never think of breaking open a water pipe?"

"You're punished for breaking things. Or I was. Maybe not you, you're human."

"Did you ever think of escaping, breaking out? It's a soldier's duty, when captured by the enemy, to escape. Survive, escape, sabotage, in that order."

"Enemy?" She looked upward at the whole weight of House Ryoval pressing overhead. "Who are my friends?"

"Ah. Yes. There is that . . . point." And where would an eight-foot-tall genetic cocktail with fangs run to? He took a deep breath. No question what his next move must be. Duty, expediency, survival, all compelled it. "Your friends are closer than you think. Why do you think I came here?" *Why, indeed?*

She shot him a silent, puzzled frown.

"I came for you. I'd heard of you. I'm . . . recruiting. Or I was. Things went wrong, and now I'm escaping. But if you came with me, you could join the Dendarii Mercenaries. A top outfit —always looking for a few good men, or whatever. I have this master-sergeant who . . . who *needs* a recruit like you." Too true. Sergeant Dyeb was infamous for his sour attitude about women soldiers, insisting that they were too soft. Any female recruit who survived his course came out with her aggression highly developed. Miles pictured Dyeb being dangled by his toes from a height of about eight feet. . . . He controlled his runaway imagination in favor of concentrating on the present crisis. Nine was looking—unimpressed.

"Very funny," she said coldly, making Miles wonder for a wild moment if she'd been equipped with the telepathy gene complex—no, she predated that—"but I'm not even human. Or hadn't you heard?"

Miles shrugged carefully. "Human is as human does." He forced himself to reach out and touch her damp cheek. "Animals don't weep, Nine."

She jerked, as from an electric shock. "Animals don't lie. Humans do. All the time."

"Not *all* the time." He hoped the light was too dim for her to see the flush in his face. She was watching his face intently.

"Prove it." She tilted her head as she sat cross-legged. Her pale gold eyes were suddenly burning, speculative.

"Uh . . . sure. How?"

"Take off your clothes."

" . . . what?"

"Take off your clothes, and lie down with me as *humans* do. Men and women." Her hand reached out to touch his throat.

The pressing claws made little wells in his flesh. "Blrp?" choked Miles. His eyes felt wide as saucers. A little more pressure, and those wells would spring forth red fountains. *I am about to die. . . .*

She stared into his face with a strange, frightening, bottomless hunger. Then abruptly, she released him. He sprang up and cracked his head on the low ceiling, and dropped back down, the stars in his eyes unrelated to love at first sight.

Her lips wrinkled back on a fanged groan of despair. "Ugly," she wailed. Her clawed nails raked across her cheeks leaving red furrows. "Too *ugly* . . . animal . . . you *don't* think I'm human—" She seemed to swell with some destructive resolve.

"No, no, no!" gibbered Miles, lurching to his knees and grabbing her hands and pulling them down. "It's not that. It's just, uh—how old are you, anyway?"

"Sixteen."

Sixteen. God. He remembered sixteen. Sex-obsessed and dying inside every minute. A horrible age to be trapped in a twisted, fragile, abnormal body. God only knew how he had survived his own self-hatred then. No—he remembered how. *He'd* been saved by one who loved him. "Aren't you a little young for this?" he tried hopefully.

"How old were you?"

"Fifteen," he admitted, before thinking to lie. "But . . . it was traumatic. Didn't work out at all in the long run."

Her claws turned toward her face again.

"Don't *do* that!" he cried, hanging on. It reminded him entirely too much of the episode of Sergeant Bothari and the knife. The Sergeant had taken Miles's knife away from him by superior force. Not an option open to Miles here. "Will you *calm down?*" he yelled at her.

She hesitated.

"It's just that, uh, an officer and gentleman doesn't just fling himself onto his lady on the bare ground. One . . . one sits down. Gets comfortable. Has a little conversation, drinks a little wine, plays a little music . . . slows down. You're hardly warm yet. Here, sit over here where it is warmest." He positioned her nearer the broken duct, got up on his knees behind her, tried rubbing her neck and shoulders. Her muscles were tense, they felt like rocks under his thumbs. Any attempt on his part to strangle her would clearly be futile.

I can't believe this. Trapped in Ryoval's basement with a sex-starved teenage werewolf. There was nothing about this in any of my Imperial Academy training manuals. . . . He remembered his mission, which was to get her left calf muscle back to the *Ariel* alive. *Dr. Canaba, if I survive, you and I are going to have a little talk about this. . . .*

Her voice was muffled with grief and the odd shape of her mouth. "You think I'm too tall."

"Not at all." He was getting hold of himself a bit, he could lie faster. "I adore tall women, ask anyone who knows me. Besides, I made the happy discovery some time back that height difference only matters when we're standing up. When we're lying down it's, ah, less of a problem . . ." A rapid mental review of everything he'd ever learned by trial and error, mostly error, about women was streaming uninvited through his mind. It was harrowing. What did women *want?*

He shifted around and took her hand, earnestly. She stared back equally earnestly, waiting for . . . *instruction*. At this point the realization came over Miles that he was facing his first virgin. He smiled at her in total paralysis for several seconds. "Nine, you've never done this before, have you?"

"I've seen vids." She frowned introspectively. "They usually start with kisses, but—" a vague gesture toward her misshapen mouth, "maybe you don't want to."

Miles tried not to think about the late rat. She'd been systematically starved, after all. "Vids can be very misleading. For women—especially the first time—it takes practice to learn your own body responses, woman friends have told me. I'm afraid I might hurt you." *And then you'll disembowel me.*

She gazed into his eyes. "That's all right. I have a very high pain threshold."

But I don't.

This was mad. She was mad. *He* was mad. Yet he could feel a creeping fascination for the—proposition—rising from his belly to his brain like a fey fog. No doubt about it, she was the tallest female thing he was ever likely to meet. More than one woman of his acquaintance had accused him of wanting to go mountain-climbing. He could get that out of his system once and for all. . . .

Damn, I do believe she'd clean up

good. She was not without a certain . . . charm was *not* the word—whatever beauty there was to be found in the strong, the swift, the leanly athletic, the functioning form. Once you got used to the *scale* of it. She radiated a smooth heat he could feel from here—*animal magnetism?* the suppressed observer in the back of his brain suggested. Power? Whatever else it was, it would certainly be *astonishing*.

One of his mother's favorite aphorisms drifted through his head. *Anything worth doing,* she always said, *is worth doing well.*

Dizzy as a drunkard, he abandoned the crutch of logic for the wings of inspiration. "Well then, doctor," he heard himself muttering insanely, "let us experiment."

Kissing a woman with fangs was indeed a novel sensation. Being kissed back—she was clearly a fast learner—was even more novel. Her arms circled him ecstatically, and from that point on he lost control of the situation, somehow. Though some time later, coming up for air, he did look up to ask, "Nine, have you ever heard of the black widow spider?"

"No . . . what is it?"

"Never mind," he said airily.

It was all very awkward and clumsy, but sincere, and when he was done the water in her eyes was from joy, not pain. She seemed enormously (how else?) pleased with him. He was so unstrung he actually fell asleep for a few minutes, pillowed on her body.

He woke up laughing.

"You really do have the most elegant cheekbones," he told her, tracing their line with one finger. She leaned into his touch, cuddled up equally to him and the heat pipe. "There's a woman on my ship who wears her hair in a sort of woven braid in the back—it would look just great on you. Maybe she could teach you how."

She pulled a wad of her hair forward and looked cross-eyed at it, as if trying to see past the coarse tangles and filth. She touched his face in turn. "You are very handsome, Admiral."

"Huh? Me?" He ran a hand over the night's beard stubble, sharp features, the old pain lines. . . . *She must be blinded by my putative rank, eh?*

"Your face is very . . . alive. And your eyes see what they're looking at."

"Nine . . . " he cleared his throat, paused. "Dammit, that's not a name, that's a number. What happened to Ten?"

"He died." *Maybe I will too,* her strange-colored eyes added silently, before her lids shuttered them.

"Is Nine all they ever called you?"

"There's a long biocomputer codestring that's my actual designation."

"Well, we all have serial numbers," Miles had two, now that he thought of it, "but this is absurd. I can't call you Nine, like some robot. You need a proper name, a name that fits you." He leaned back onto her warm bare shoulder—she was like a furnace, they had spoken truly about her metabolism—and his lips drew back on a slow grin. "Taura."

"Taura?" Her long mouth gave it a skewed and lilting accent. " . . . it's too beautiful for me!"

"Taura," he repeated firmly. "Beautiful but strong. Full of secret meaning.

Perfect. Ah, speaking of secrets . . . '' Was now the time to tell her about what Dr. Canaba had planted in her left calf? Or would she be hurt, as someone falsely courted for her money—or his title—Miles faltered. ''I think, now that we know each other better, that it's time for us to blow out of this place.''

She stared around, into the grim dimness. ''How?''

''Well, that's what we have to figure out, eh? I confess, ducts rather spring to my mind.'' Not the heat pipe, obviously. He'd have to go anorexic for months to fit in it, besides, he'd cook. He shook out and pulled on his black T-shirt—he'd put on his trousers immediately after he'd woke, that stone floor sucked heat remorselessly from any flesh that touched it—and creaked to his feet. God. He was getting too old for this sort of thing already. The sixteen-year-old, clearly, possessed the physical resiliance of a minor goddess. What was it he'd gotten into at sixteen? Sand, that was it. He winced in memory of what it had done to certain sensitive body folds and crevices. Maybe cold stone wasn't so bad after all.

She pulled her pale green coat and trousers out from under herself, dressed, and followed him in a crouch until the space was sufficient for her to stand upright.

They quartered and re-quartered the underground chamber. There were four ladders with hatches, all locked. There was a locked vehicle exit to the outside on the downslope side. A direct breakout might be simplest, but if he couldn't make immediate contact with Thorne it was a 27-kilometer hike to the nearest town. In the snow, in his sock feet—her bare feet. And if they got there, he wouldn't be able to use the vidnet anyway because his credit card was still locked in the Security Ops office upstairs. Asking for charity in Ryoval's town was a dubious proposition. So, break straight out and be sorry later, or linger and try to equip themselves, risking recapture, and be sorry sooner? Tactical decisions were such fun.

Ducts won. Miles pointed upward to the most likely one. ''Think you can break that open and boost me in?'' he asked Taura.

She studied it, nodded slowly, the expression closing on her face. She stretched up and moved along to a soft metal clad joint, slipped her claw-hard fingernails under the strip, and yanked it off. She worked her fingers into the exposed slot and hung on it as if chinning herself. The duct bent open under her weight. ''There you go,'' she said.

She lifted him up as easily as a child, and he squirmed into the duct. This one was a particularly tight fit, though it was the largest he had spotted as accessible in this ceiling. He inched along it on his back. He had to stop twice to suppress a residual, hysteria-tinged laughing fit. The duct curved upward, and he slithered around the curve in the darkness only to find that it split here into a Y, each branch half-sized. He cursed and backed out.

Taura had her face turned up to him, an unusual angle of view.

''No good that way,'' he gasped, reversing direction gymnastically at the gap. He headed the other way. This too curved up, but within moments he found a grille. A tightly-fitted, unbudgable, unbreakable, and with his bare hands,

uncuttable grille. Taura might have the strength to rip it out of the wall, but Taura couldn't fit through the duct to reach it. He contemplated it a few moments. "Right," he muttered, and backed out again.

"So much for ducts," he reported to Taura. "Uh . . . could you help me down?" She lowered him to the floor, and he dusted himself futilely. "Let's look around some more."

She followed him docilely enough, though something in her expression hinted she might be losing faith in his admiralness. A bit of detailing on a column caught his eye, and he went to take a closer look in the dim light.

It was one of the low-vibration support columns. Two meters in diameter, set deep in the bedrock in a well of fluid, it ran straight up to one of the labs, no doubt, to provide an ultra-stable base for certain kinds of crystal generation projects and the like. Miles rapped on the side of the column. It rang hollow. *Ah yes, makes sense, concrete doesn't float too well, eh?* A groove in the side outlined . . . an access port? He ran his fingers around it, probing. There was a concealed—something. He stretched his arms and found a twin spot on the opposite side. The spots yielded slowly to the hard pressure of his thumbs. There was a sudden pop and hiss, and the whole panel came away. He staggered, and barely kept from dropping it down the hole. He turned it sideways and drew it out.

"Well, well," Miles grinned. He stuck his head through the port, looked down and up. Black as pitch. Rather gingerly, he reached his arm in and felt around. There was a ladder running up the damp inside, for access for cleaning and repairs; the whole column could apparently be filled with fluid of whatever density at need. Filled, it would have been self-pressure-sealed and unopenable. Carefully, he examined the inner edge of the hatch. Openable from either side, by God. "Let's go see if there's any more of these, further up."

It was slow going, feeling for more grooves as they ascended in the blackness. Miles tried not to think about the fall, should he slip from the slimy ladder. Taura's deep breathing, below him, was actually rather comforting. They had gone up perhaps three stories when Miles's chilled and numbing fingers found another groove. He'd almost missed it, it was on the opposite side of the ladder from the first. He then discovered, the hard way, that he didn't have nearly the reach to keep one arm hooked around the ladder and press both release catches at the same time. After a terrifying slip, trying, he clung spasmodically to the ladder till his heart stopped pounding. "Taura?" he croaked. "I'll move up, and you try it." Not much up was left, the column ended a meter or so above his head.

Her extra arm length was all that was needed, the catches surrendered to her big hands with a squeak of protest.

"What do you see?" Miles whispered.

"Big dark room. Maybe a lab."

"Makes sense. Climb back down and put that lower panel back on, no sense advertising where we went."

Miles slipped through the hatch into the darkened laboratory while Taura accomplished her chore. He dared not switch on a light in the windowless

room, but a few instrument readouts on the benches and walls gave enough ghostly glow for his dark-adapted eyes that at least he didn't trip over anything. One glass door led to a hallway. A heavily electronically monitored hallway. With his nose pressed to the glass Miles saw a red shape flit past a cross-corridor; guards here. What did they guard?

Taura oozed out of the access hatch to the column—it was a tight fit—and sat down heavily on the floor, her face in her hands. Concerned, Miles nipped back to her. "You all right?"

She shook her head. "No. Hungry."

"What, already? That was supposed to be a twenty-four hour rat—er, ration bar." Not to mention the two or three kilos of meat she'd had for an appetizer.

"For you, maybe," she wheezed. She was shaking.

Miles began to see why Canaba had dubbed his project a failure. Imagine trying to feed a whole army of such appetites. Napoleon would quail. Maybe the raw-boned kid was still growing. Daunting thought.

There was a refrigerator at the back of the lab. If he knew lab techs . . . ah ha. Indeed, in among the test tubes was a package with half a sandwich and a large, if bruised, pear. He handed them to Taura. She looked vastly impressed, as if he'd conjured them from his sleeve by magic, and devoured them at once, and grew less pale.

Miles foraged further for his troop. Alas, the only other organics in the fridge were little covered dishes of gelatinous stuff with unpleasant multi-colored fuzz growing in them. But there were three big shiny walk-in wall freezers lined up in a row. Miles peered through a glass square in one thick door, and risked pressing the wall pad that turned on the light inside. Within were row on row on row of labeled drawers, full of clear plastic trays. Frozen samples of some kind. Thousands—Miles looked again, and calculated more carefully—hundreds of thousands. He glanced at the lighted control panel by the freezer drawer. The temperature inside was that of liquid nitrogen. Three freezers . . . *millions* of . . . Miles sat down abruptly on the floor himself. "Taura, do you know where we *are?*" he whispered intensly.

"Sorry, no," she whispered back, creeping over.

"That was a rhetorical question. *I* know where we are."

"Where?"

"Ryoval's treasure chamber."

"What?"

"That," Miles jerked his thumb at the freezer, "is the baron's hundred-year-old tissue collection. My God. Its value is almost incalcuable. Every unique, irreplacable, mutant bizarre bit he's begged, bought, borrowed or stolen for the last three-fourths of a century, all lined up in neat little rows, waiting to be thawed and cultured and cooked up into some poor new slave. This is the living heart of his whole human biologicals operation." Miles sprang to his feet and pored over the control panels. His heart raced, and he breathed open-mouthed, laughing silently, feeling almost like he was about to pass out. "Oh, shit. Oh, God." He stopped, swallowed. Could it be done?

These freezers had to have an alarm system, monitors surely, piped up to Security Ops at the very least. Yes,

there was a complex device for opening the door—that was fine, he didn't want to open the door. He left it untouched. It was systems readout he was after. If he could bugger up just one sensor . . . Was the thing broadcast-output to several outside monitor locations, or did they run an optic thread to just one? The lab benches supplied him with a small hand light, and drawers and drawers of assorted tools and supplies. Taura watched him in puzzlement as he darted here, there, taking inventory.

The freezer monitor *was* broadcast-output, inaccessable, could he hit it on the input side? He levered off a smoke-dark plastic cover as silently as he could. There, *there*, the optic thread came out of the wall, pumping continuous information about the freezer's interior environment. It fit into a simple standard receiver plug on the more daunting black box that controlled the door alarm. There'd been a whole drawer full of assorted optic threads with various ends and Y-adaptors . . . Out of the spaghetti-tangle he drew what he needed, discarding several with broken ends or other damage. There were three optical data recorders in the drawer. Two didn't work. The third did.

A quick festoon of optic thread, a swift unplugging and plugging, and he had one freezer talking to two control boxes. He set the freed thread to talking to the datacorder. He simply had to chance the blip during transfer. If anyone checked they'd find all seemed well again. He gave the datacorder several minutes to develop a nice continuous replay loop, crouching very still with even the tiny hand light extinguished. Taura waited with the patience of a predator, making no noise.

One, two, three, and he set the datacorder to talking to all three control boxes. The real thread plugs hung forlornly loose. Would it work? There were no alarms going off, no thundering herd of irate security troops.

"Taura, come here."

She loomed beside him, baffled.

"Have you ever met Baron Ryoval?" asked Miles.

"Yes, once—when he came to buy me."

"Did you like him?"

She gave him an are-you-out-of-your-mind? look.

"Yeah, I didn't much care for him either." Restrained murder, in point of fact. He was now meltingly grateful for that restraint. "Would you like to rip his lungs out, if you could?"

Her clawed hands clenched. "Try me!"

"Good!" He smiled cheerily. "I want to give you your first lesson in tactics." He pointed. "See that control? The temperature in these freezers can be raised to almost 200 degrees centigrade, for heat sterilization during cleaning. Give me your finger. One finger. Gently. More gently than that." He guided her hand. "The least possible pressure you can apply to the dial, and still move. . . . Now the next," he pulled her to the next panel, "and the last." He exhaled, still not quite able to believe it.

"And the lesson is," he breathed, "it's not how much force you use. It's where you apply it."

He resisted the urge to scrawl something like *The Dwarf Strikes Back* across

the front of the freezers with a flow pen. The longer the baron in his mortal rage took to figure out who to pursue, the better. It would take several hours to bring all that mass in there from liquid nitrogen temperature up to *well-done*, but if no one came in till morning shift, the destruction would be absolute.

Miles glanced at the time on the wall digital. Dear God, he'd spent a lot of time in that basement. Well-spent, but still. "Now," he said to Taura, who was still meditating on the dial, and her hand, with her gold eyes glowing, "we have to get out of here. Now we *really* have to get out of here." Lest her next tactics lesson turns out to be, Don't blow up the bridge you're standing on, Miles allowed nervously.

Contemplating the door-locking mechanism more closely, plus what lay beyond—among other things, the sound-activated wall-mounted monitors in the halls featured automatic laser fire—Miles almost went to turn the freezer temperatures back down. His chip-driven Dendarii tools, now locked in the Security Ops office, might barely have handled the complex circuitry in the pried-open control box. But of course, he couldn't get at his tools without his tools—a nice paradox. It shouldn't surprise Miles that Ryoval saved his most sophisticated alarm system for this lab's one and only door. But it made the room a much worse trap than even the sub-basement.

He made another tour of the lab with the filched hand light, checking drawers again. No computer-keys came to hand, but he did find a big, crude pair of cutters in a drawer full of rings and clamps, and bethought him of the duct grille that had lately defeated him in the basement. So. The passage up to this lab had merely been the illusion of progress toward escape.

"There's no shame in a strategic retreat to a better position," he whispered to Taura when she balked at reentering the support column's dark tube. "This is a dead end, here. Maybe literally." The doubt in her tawny eyes was strangely unsettling, a weight in his heart. *Still don't trust me, eh? Well, maybe those who have been greatly betrayed need great proof.* "Stick with me, kid," he muttered under his breath, swinging into the tube. "We're going places." Her doubt was merely masked under lowered eyelids, but she followed him, sealing the hatch behind them.

With the hand light, the descent was slightly less nasty than the ascent into the unknown had been. There were no other exits to be found, and shortly they stood on the stone they had started from. Miles checked the progress of their ceiling waterspout, while Taura drank again. The splattering water ran off in a flat greasy trickle downslope; given the vast size of the chamber, it would be some days before the pool collecting slowly against the lower wall offered any useful strategic possibilities, though there was always the hope it might do a bit to undermine the foundations.

Taura boosted him back into the duct. "Wish me luck," he murmured over his shoulder, muffled by the close confines.

"Goodbye," she said. He could not see the expression on her face; there was none in her voice.

"See you later," he corrected this firmly.

A few minutes of vigorous wriggling brought him back to his grille. It opened

onto a dark room stacked with stuff, part of the basement proper, quiet and unoccupied. The snip of his cutters, biting through the grille, seemed loud enough to bring down Ryoval's entire security force, but none appeared. Maybe the security chief was sleeping off his drug hangover. A scrabbling noise, not of Miles's own making, echoed thinly through the duct and Miles froze. He flashed his light down a side-branching tube. Twin red jewels flashed back, the eyes of a huge rat. He briefly considered trying to clout it and haul it back to Taura. No. When they got back to the *Ariel*, he'd give her a steak dinner. Two steak dinners. The rat saved itself by turning and scampering away.

The grilled parted at last, and he squeezed into the storage room. What time was it, anyway? Late, very late. The room gave onto a corridor, and on the floor at the end, one of the access hatches gleamed dully. Miles's heart rose in serious hope. Once he'd got Taura, they must next try to reach a vehicle . . .

This hatch, like the first, was manual, no sophisticated electronics to disarm. It relocked automatically upon closing, however. Miles jammed it with his clippers before descending the ladder. He aimed his light around. "Taura!" he whispered. "Where are you?"

No immediate answer; no glowing gold eyes flashing in the forest of pillars. He was reluctant to shout. He slapped down the rungs and began a silent fast trot through the chamber, the cold stone draining the heat through his socks and making him long for his lost boots.

He came upon her sitting silently at the base of a pillar, her head turned sideways resting on her knees. Her face was pensive, sad. Really, it didn't take long at all to begin reading the subtleties of feeling in her wolfish features.

"Time to march, soldier girl," Miles said.

Her head lifted. "You came back!"

"What did you think I was going to do? Of course I came back. You're my recruit, aren't you?"

She scrubbed her face with the back of a big paw—hand, Miles corrected himself severely—and stood up, and up. "Guess I must be." Her outslung mouth smiled slightly. If you didn't have a clue what the expression was, it could look quite alarming.

"I've got a hatch open. We've got to try to get out of this main building, back to the utility bay. I saw several vehicles parked there earlier. What's a little theft, after—"

With a sudden whine the outside vehicle entrance, downslope to their right, began to slide upward. A rush of cold dry air swept through the dankness, and a thin shaft of yellow dawn light made the shadows blue. They shielded their eyes in the unexpected glare. Out of the bright squinting haze coalesced half-a-dozen red-clad forms, double-timing it, weapons at the ready.

Taura's hand was tight on Miles's. *Run*, he started to cry, and bit back the shout; no way could they outrun a nerve disruptor beam, a weapon which at least two of the guards now carried. Miles's breath hissed out through his teeth. He was too infuriated even to swear. They'd been so *close*. . . .

Security Chief Moglia sauntered up. "What, still in one piece, Naismith?"

he smirked unpleasantly. "Nine must have finally realized it's time to start cooperating, eh, Nine?"

Miles squeezed her hand hard, hoping the message would be properly understood as, *Wait.*

She lifted her chin. "Guess so," she said coldly.

"It's about time," said Moglia. "Be a good girl, and we'll take you upstairs and feed you breakfast after this."

Good, Miles's hand signalled. She was watching him closely for cues, now.

Moglia prodded Miles with his truncheon. "Time to go, dwarf. Your friends have actually made ransom. Surprised me."

Miles was surprised himself. He moved toward the exit, still towing Taura. He didn't look at her, did as little as possible to draw unwanted attention to their, er, togetherness, while still maintaining it. He let go of her hand as soon as their momentum was established.

What the hell? Miles thought as they emerged into the blinking dawn, up the ramp and onto a circle of tarmac slick with glittering rime. A most peculiar tableau was arranged there.

Bel Thorne and one Dendarii trooper, armed with stunners, shifted uneasily — not prisoners? Half a dozen armed men in the green uniform of House Fell stood at the ready. A float truck emblazoned with Fell's logo was parked at the tarmac's edge. And Nicol the quaddie, wrapped in white fur against the frost, hovered in her float chair at the stunner-point of a big green-clad guard. The light was grey and gold and chilly as the sun, lifting over the dark mountains in the distance, broke through the clouds.

"Is that the man you want?" the green-uniformed guard captain asked Bel Thorne.

"That's him." Thorne's face was white with an odd mixture of relief and distress. "Admiral, are you all right?" Thorne called urgently. Its eyes widened, taking in Miles's tall companion. "What the hell's *that?*"

"*She* is Recruit-trainee Taura," Miles said firmly, hoping 1) Bel would unravel the several meanings packed in that sentence and 2) Ryoval's guards wouldn't. Bel looked stunned, so evidently Miles had got at least partly through; Security Chief Moglia looked suspicious, but baffled. Miles was clearly a problem Moglia thought he was about to get rid of, however, and he thrust his bafflement aside to deal with the more important person of Fell's guard captain.

"What *is* this?" Miles hissed at Bel, sidling closer until a red-clad guard lifted his nerve disruptor and shook his head. Moglia and Fell's captain were exchanging electronic data on a report panel, heads bent together, evidently the official documentation.

"When we lost you last night, I was in a panic," Bel pitched its voice low toward Miles. "A frontal assault was out of the question. So I ran to Baron Fell to ask for help. But the help I got wasn't quite what I expected. Fell and Ryoval cooked up a deal between them to exchange Nicol for you. I swear, I only found out the details an hour ago!" Bel protested at Nicol's thin-lipped glower in its direction.

"I . . . see." Miles paused. "Are we planning to refund her dollar?"

"*Sir,*" Bel's voice was anguished, "we had *no idea* what was happening to you in there. We were expecting Ryoval to start beaming up a holocast of obscene and ingenious tortures, starring you, at any minute. Like Commodore Tung says, on hemmed-in ground, use subterfuge."

Miles recognized one of Tung's favorite Sun Tzu aphorisms. On bad days Tung had a habit of quoting the 4,000-year-dead general in the original Chinese; when Tung was feeling benign they got a translation. Miles glanced around, adding up weapons, men, equipment. Most of the green guards carried stunners. Thirteen to . . . three? Four? He glanced at Nicol. Maybe five? *On desperate ground,* Sun Tzu advised, *fight.* Could it get much more desperate than this?

"Ah . . . " said Miles. "Just what the devil did we offer Baron Fell in exchange for this extraordinary charity? Or is he doing it out of the goodness of his heart?"

Bel shot him an exasperated look, then cleared its throat. "I promised you'd tell him the real truth about the Betan rejuvenation treatment."

"*Bel . . . "*

Thorne shrugged unhappily. "I thought, once we'd got you back, we'd figure something out. But I never thought he'd offer Nicol to Ryoval, I swear!"

Down in the long valley, Miles could see a bead moving on the thin gleam of a monorail. The morning shift of bioengineers and technicians, janitors and office clerks and cafeteria cooks, was due to arrive soon. Miles glanced at the white building looming above, pictured the scene to come in that third floor lab as the guards deactivated the alarms and let them in to work, as the first one through the door sniffed and wrinkled his nose and said plaintively, "What's that awful *smell?*"

"Has 'Medtech Vaughn' signed aboard the *Ariel* yet?" Miles asked.

"Within the hour."

"Yeah, well . . . it turns out we didn't need to kill his fatted calf after all. It comes with the package." Miles nodded toward Taura.

Bel lowered its voice still further. "*That's* coming with us?"

"You'd better believe it. Vaughn didn't tell us everything. To put it mildly. I'll explain later," Miles added as the two guard captains broke up their tete-a-tete. Moglia swung his truncheon jauntily, heading toward Miles. "Meantime, you made a slight miscalculation. This isn't hemmed-in ground. This is *desperate* ground. Nicol, I want you to know, the Dendarii don't give refunds."

Nicol frowned in bewilderment. Bel's eyes widened, as it checked out the odds—calculating them thirteen to three, Miles could tell. "Truly?" Bel choked. A subtle hand signal, down by its trouser seam, brought the trooper to full alert.

"Truly desperate," Miles reiterated. He inhaled deeply. "Now! Taura, attack!"

Miles launched himself toward Moglia, not so much actually expecting to wrestle his truncheon from him as hoping to maneuver Moglia's body between himself and the fellows with the nerve disruptors. The Dendarii trooper, who

had been paying attention to details, dropped one of the nerve disruptor wielders with his first stunner shot, then rolled away from the second's return fire. Bel dropped the second nerve disruptor man and leapt aside. Two red guards, aiming their stunners at the running hermaphrodite, were lifted abruptly by their necks. Taura cracked their heads together, unscientifically but hard; they fell to hands and knees, groping blindly for their lost weapons.

Fell's green guards hesitated, not certain just whom to shoot, until Nicol, her angel's face alight, suddenly shot skyward in her float chair and dropped straight down again on the head of her guard, who was distracted by the fight. He fell like an ox. Nicol flipped her floater sideways as green-guard stunner fire found her, shielding herself from its flare, and shot upwards again. Taura picked up a red guard and threw him at a green one; they both went down in a tangle of arms and legs.

The Dendarii trooper closed on a green guard hand-to-hand, to shield himself from stunner blast. Fell's captain wouldn't buy the maneuver, and ruthlessly stunned them both, a sound tactic with the numbers on his side. Moglia got his truncheon up against Miles's windpipe and started to press, while yelling into his wrist comm, calling for back-up from Security Ops. A green guard screamed as Taura yanked his arm out of its shoulder socket and swung him into the air by the dislocated joint at another one aiming his stunner at her.

Colored lights danced before Miles's eyes. Fell's captain, focusing on Taura as the biggest threat, dropped to stunner fire from Bel Thorne as Nicol whammed her float chair into the back of the last green guard left standing.

"The float truck!" Miles croaked. "Go for the float truck!" Bell cast him a desperate look and sprinted toward it. Miles fought like an eel until Moglia got a hand down to his boot, drew a sharp, thin knife, and pressed it to Miles's neck.

"Hold still!" snarled Moglia. "That's better . . . " He straightened in the sudden silence, realizing he'd just pulled domination from disaster. "*Everybody* hold still." Bel froze with its hand on the float-truck's door pad. A couple of the men splayed on the tarmac twitched and moaned.

"Now stand away from—glk," said Moglia.

Taura's voice whispered past Moglia's ear, a soft, soft growl. "Drop the knife. Or I'll rip your throat out with my bare hands."

Miles's eyes wrenched sideways, trying to see around his own clamped head, as the sharp edge sang against his skin.

"I can kill him, before you do," croaked Moglia.

"The little man is mine," Taura crooned. "You gave him to me yourself. He came *back* for me. Hurt him one little bit, and I'll tear your head off and then I'll drink your blood."

Miles felt Moglia being lifted off his feet. The knife clattered to the pavement. Miles sprang away, staggering. Taura held Moglia by his neck, her claws biting deep. "I still want to rip his head off," she growled petulantly, remembrance of abuse sparking in her eyes.

"Leave him," gasped Miles. "Believe me, in a few hours he's going to be suffering a more artistic vengeance than anything we can dream up."

Bel galloped back to stun the security chief at can't miss range while Taura held him out like a wet cat. Miles had Taura throw the unconscious Dendarii over her shoulder while he ran around to the back of the float-truck and released the doors for Nicol, who zipped her chair inside. They tumbled within, dropped the doors, and Bel at the controls shot them into the air. A siren was going off somewhere in Ryoval's.

"Wrist comm, wrist comm," Miles babbled, stripping his unconscious trooper of the device. "Bel, where is our drop shuttle parked?"

"We came in at a little commercial shuttleport just outside Ryoval's town, about forty kilometers from here."

"Anybody left manning it?"

"Anderson and Nout."

"What's their scrambled comm channel?"

"Twenty-three."

Miles slid into the seat beside Bel and opened the channel. It took a small eternity for Sergeant Anderson to answer, fully thirty or forty seconds, while the float truck streaked above the treetops and over the nearest ridge.

"Laureen, I want you to get your shuttle into the air. We need an emergency pick-up, soonest. We're in a House Fell float truck, heading—" Miles thrust his wrist under Bel's nose.

"North from Ryoval Biologicals," Bel recited. "At about 260 kilometers per hour, which is the fastest this crate will go."

"Home in on our screamer," Miles set the wrist comm emergency signal. "Don't wait for clearance from Ryoval's shuttleport traffic control, 'cause you won't get it. Have Nout patch my comm through to the *Ariel*."

"You got it, sir," Anderson's thin voice came cheerily back over his comm.

Static, and another few seconds' excruciating delay. Then an excited voice, "Murka here. I thought you were coming out right behind us last night! You all right, sir?"

"Temporarily. Is 'Medtech Vaughn' aboard?"

"Yes, sir."

"All right. Don't let him off. Assure him I have his tissue sample with me."

"Really! How'd you—"

"Never mind how. Get all the troops back aboard and break from the station into free orbit. Plan to make a flying pick-up of the drop shuttle, and tell the pilot-officer to plot a course for the Escobar wormhole jump at max acceleration as soon as we're clamped on. Don't wait for clearance."

"We're still loading cargo—"

"Abandon any that's still unloaded."

"Are we in serious shit, sir?"

"Mortal, Murka."

"Right, sir. Murka out."

"I thought we were all supposed to be as quiet as mice here on Jackson's Whole," Bel complained. "Isn't this all a bit splashy?"

"The situation's changed. There'd be no negotiating with Ryoval for Nicol, or for Taura either, after what we did last night. I struck a blow for truth and justice back there that I may live to regret, briefly. Tell you about it later. Anyway, do you really want to stick around while I explain to Baron Fell the

real truth about the Betan rejuvenation treatment?''

''Oh,'' Thorne's eyes were alight, as it concentrated on its flying, ''I'd pay money to watch that, sir.''

''Ha. No. For one last moment back there, all the pieces were in our hands. Potentially, anyway.'' Miles began exploring the readouts on the float-truck's simple control panel. ''We'd never get everybody together again, never. One maneuvers to the limit, but the golden moment demands action. If you miss it, the gods damn you forever. And vice versa. Speaking of action, did you see Taura take out *seven* of those guys?'' Miles chortled in memory. ''What's she going to be like after basic training?'

Bel glanced uneasily over its shoulder, to where Nicol had her float chair lodged and Taura hunkered in the back along with the body of the unconscious trooper. ''I was too busy to keep count.''

Miles swung out of his seat, and made his way into the back to check on their precious live cargo.

''Nicol, you were great,'' he told her. ''You fought like a falcon. I may have to give you a discount on that dollar.''

Nicol was still breathless, ivory cheeks flushed. An upper hand shoved a strand of black hair out of her sparkling eyes. ''I was afraid they'd break my dulcimer.'' A lower hand stroked a big box-shaped case jammed into the float-chair's cup beside her. ''Then I was afraid they'd break Bel.''

Taura sat leaning against the truck wall, a bit green.

Miles knelt beside her. ''Taura dear, are you all right?'' He gently lifted one clawed hand to check her pulse, which was bounding. Nicol gave him a rather strange look at this tender gesture; her float chair was wedged as far from Taura as it could get.

''Hungry,'' Taura gasped.

''Again? But of course, all that energy expenditure. Anybody got a ration bar?'' A quick check found an only-slightly-nibbled rat bar in the stunned trooper's thigh pocket, which Miles immediately liberated. Miles smiled benignly at Taura as she wolfed it down; she smiled back as best she could with her mouth full. *No more rats for you after this,* Miles promised silently. *Three steak dinners when we get back to the Ariel, and a couple of chocolate cakes for dessert. . . .*

The float-truck jinked. Taura, reviving somewhat, extended her feet to hold Nicol's dented cup in place against the far wall and keep it from bouncing around. ''Thank you,'' said Nicol warily. Taura nodded.

''Company,'' Bel Thorne called over its shoulder. Miles hastened forward.

Two aircars were coming up fast behind them. Ryoval's security. Doubtless beefed up tougher than the average civilian police car—yes. Bel jinked again as a plasma bolt boiled past, leaving bright green streaks across Miles's retinas. Quasi-military and seriously annoyed, their pursuers were.

''This is one of Fell's trucks, we ought to have *something* to fling back at them.'' There was nothing in front of Miles that looked like any kind of weapons-control.

A *whoomp*, a scream from Nicol, and the float-truck staggered in air, righted itself under Bel's hands. A roar of air and vibration—Miles cranked his head around frantically—one top back corner

of the truck's cargo area was blown away. The rear door was fused shut on one side, whanging loose along the opposite edge. Taura still braced the float chair, Nicol now had her upper hands wrapped around Taura's ankles. "Ah," said Thorne. "No armor."

"What did they think this was going to be, a peaceful mission?" Miles checked his wrist comm. "Laureen, are you in the air yet?"

"Coming, sir."

"Well, if you've ever itched to redline it, now's your chance. Nobody's going to complain about your abusing the equipment this time."

"*Thank* you, sir," she responded happily.

They were losing speed and altitude. "Hang on!" Bel yelled over its shoulder, and suddenly reversed thrust. Their closing pursuers shot past them, but immediately began climbing turns. Bel accelerated again; another scream from the back as their live cargo was thus shifted toward the now-dubious rear doors.

The Dendarii hand stunners were of no use at all. Miles clambered into the back again, looking for some sort of luggage compartment, gun rack, anything—surely Fell's people did not rely only on the fearsome reputation of their House for protection.

The padded benches along each side of the cargo compartment, upon which Fell's guard squad had presumably sat, swung up on storage space. The first was empty, the second contained personal luggage—Miles had a brief flash of strangling an enemy with someone's pajama pants, flinging underwear into thruster air-intakes—the third compartment was also empty. The fourth was locked.

The float-truck rocked under another blast, part of the top peeled away in the wind, Miles grabbed for Taura, and the truck plummeted downward. Miles's stomach, and the rest of him, seemed to float upward. They were all flattened to the floor again as Bel pulled up. The float-truck shivered and lurched, and all—Miles and Taura, the unconscious trooper, Nicol in her float chair—were flung forward in a tangle as the truck plowed to a tilted stop in a copse of frost-blackened scrub.

Bel, blood streaming down its face, clambered back to them crying "Out, out, out!" Miles stretched for the new opening in the roof, jerked his hand back at the burning touch of hot slagged metal and plastics. Taura, standing up, stuck her head out through the hole, then crouched back down to boost Miles through. He slithered to the ground, looked around. They were in an unpeopled valley of native vegetation, flanked by ropy, ridgy hills. Flying up the slot toward them came the two pursuing aircars, swelling, slowing—coming in for a capture, or just taking careful aim?

The *Ariel*'s combat drop shuttle roared up over the ridge and descended like the black hand of God. The pursuing aircars looked suddenly *much* smaller. One veered off and fled, the second was smashed to the ground not by plasma fire but by a swift swat from a tractor beam. Not even a trickle of smoke marked where it went down. The drop shuttle settled demurely beside them in a deafening crackling crush of shrubbery. Its hatch extended and unfolded

itself in a sort of suave, self-satisfied salute.

"Show-off," Miles muttered. He pulled the woozy Thorne's arm over his shoulder, Taura carried the stunned man, Nicol's battered cup stuttered through the air, and they all staggered gratefully to their rescue.

Subtle noises of protest emanated from the ship around him as Miles stepped into the *Ariel*'s shuttle hatch corridor. His stomach twitched queasily from an artificial gravity not quite in synch with overloaded engines. They were on their way, breaking orbit already. Miles wanted to get to Nav and Com as quickly as possible, though the evidence so far suggested that Murka was carrying on quite competently. Anderson and Nout hauled in the downed trooper, now moaning his way to consciousness, and turned him over to the medtech waiting with a float pallet. Thorne, who had acquired a temporary plas dressing for the forehead cut during the shuttle flight, sent Nicol in her damaged float chair after them and whisked off toward Nav and Com. Miles turned to encounter the man he least wanted to see. Dr. Canaba hovered anxiously in the corridor, his tanned face strained.

"You," said Miles to Canaba, in a voice dark with rage. Canaba stepped back involuntarily. Miles wanted, but was too short, to pin Canaba to the wall by his neck, and regretfully dismissed the idea of ordering Trooper Nout to do it for him. Miles pinned Canaba with a glare instead. "You cold-blooded, double-dealing, son-of-a-bitch. You set me up to murder a sixteen-year-old girl!"

Canaba raised his hands in protest. "You don't understand—"

Taura ducked through the shuttle hatch. Her tawny eyes widened in a surprise exceeded only by Canaba's. "Why, Dr. Canaba! What are you doing here?"

Miles pointed to Canaba. "You, stay there," he ordered thickly. He tamped his anger down and turned to the shuttle pilot. "Laureen?"

"Yes, sir?"

Miles took Taura by the hand and led her to Sergeant Anderson. "Laureen, I want you to take Recruit-trainee Taura here in tow and get her a square meal. All she can eat, and I do mean all. Then help her get a bath, a uniform, and orient her to the ship."

Anderson eyed the towering Taura warily. "Er . . . yes, sir."

"She's had a hell of a time," Miles felt compelled to explain, then paused and added, "Do us proud. It's important."

"Yes, sir," said Anderson sturdily, and led off, Taura following with an uncertain backward glance to Miles and Canaba.

Miles rubbed his stubbled chin, conscious of his stains and stink, fear-driven weariness stretching his nerves taut. He turned to the stunned geneticist. "All right, doctor," he snarled, "make me understand. Try real hard."

"I couldn't leave her in Ryoval's hands!" said Canaba in agitation. "To be made a victim, or worse, an agent of his, his merchandised depravities—"

"Didn't you ever think of asking us to rescue her?"

"But," said Canaba, confused, "why should you? It wasn't in your contract—a mercenary—"

"Doctor, you've been living on Jackson's Whole too damn long."

"I knew that back when I was throwing up every morning before going to work." Canaba drew himself up with a dry dignity. "But Admiral, you don't understand." He glanced down the corridor in the direction Taura had gone. "I couldn't leave her in Ryoval's hands. But I can't possibly take her to Barrayar. They kill mutants there!"

"Er . . . " said Miles, given pause. "They're attempting to reform those prejudices. Or so I understand. But you're quite right. Barrayar is not the place for her."

"I had hoped, when you came along, not to have to do it, to kill her myself. Not an easy task. I've known her . . . too long. But to leave her down there would have been the most vile condemnation—"

"That's no lie. Well, she's out of there now. Same as you." *If we can keep it so* . . . Miles was frantic to get to Nav and Com and find out what was happening. Had Ryoval launched pursuit yet? Had Fell? Would the space station guarding the distant wormhole exit be ordered to block their escape?

"I didn't want to just abandon her," dithered Canaba, "but I couldn't take her with me!"

"I should hope not. You're totally unfit to have charge of her. I'm going to urge her to join the Dendarii Mercenaries. It would seem to be her genetic destiny. Unless you know some reason why not?"

"But she's going to die!"

Miles stopped short. "And you and I are not?" he said softly after a moment, then more loudly, "Why? How soon?"

"It's her metabolism. Another mistake, or concatenation of mistakes. I don't know when, exactly. She could go another year, or two, or five. Or ten."

"Or fifteen?"

"Or fifteen, yes, though not likely. But early, still."

"And yet you wanted to take from her what little she had? Why?"

"To spare her. The final debilitation is rapid, but very painful, to judge from what some of the other . . . prototypes, went through. The females were more complex than the males, I'm not certain. . . . But it's a ghastly death. Especially ghastly as Ryoval's slave."

"I don't recall encountering a lovely death yet. And I've seen a variety. As for duration, I tell you we could all go in the next fifteen minutes, and where is your tender mercy then?" He *had* to get to Nav and Com. "I declare your interest in her forfeit, doctor. Meanwhile, let her grab what life she can."

"But she was my project—I must answer for her—"

"No. She's a free woman now. She must answer for herself."

"How free can she ever be, in that body, driven by that metabolism, that face—a freak's life—better to die painlessly, than to have all that suffering inflicted on her—"

Miles spoke through his teeth. With emphasis. "No. It's. Not."

Canaba stared at him, shaken out of the rutted circle of his unhappy reasoning at last.

That's right, doctor, Miles's thought

glittered. *Get your head out of your ass and look at me. Finally.*

"Why should . . . you care?" asked Canaba.

"I like her. Rather better than I like you, I might add." Miles paused, daunted by the thought of having to explain to Taura about the gene complexes in her calf. And sooner or later they'd have to retrieve them. Unless he could fake it, pretend the biopsy was some sort of medical standard operating procedure for Dendarii induction—no. She deserved more honesty than that.

Miles was highly annoyed at Canaba for putting this false note between himself and Taura and yet—without the gene complexes, would he have indeed have gone in after her as his boast implied? Extended and endangered his assigned mission just out of the goodness of his heart, yeah? Devotion to duty, or pragmatic ruthlessness, which was which? He would never know, now. His anger receded, and exhaustion washed in, the familiar post-mission down—too soon, the mission was far from over, Miles reminded himself sternly. He inhaled. "You can't save her from being alive, Dr. Canaba. Too late. Let her go. Let *go*."

Canaba's lips were unhappily tight, but, head bowing, he turned his hands palm-out.

"Page the Admiral," Miles heard Thorne say as he entered Nav and Com, then "Belay that," as heads swivelled toward the swish of the doors and they saw Miles. "Good timing, sir."

"What's up?" Miles swung into the com station chair Thorne indicated. Ensign Murka was monitoring ship's shielding and weapons systems, while their Jump pilot sat at the ready beneath the strange crown of his headset with its chemical cannulas and wires. Pilot Padget's expression was inward, controlled and meditative; his consciousness fully engaged, even merged, with the *Ariel*. Good man.

"Baron Ryoval is on the com for you," said Thorne. "Personally."

"I wonder if he's checked his freezers yet?" Miles settled in before the vid link. "How long have I kept him waiting?"

"Less than a minute," said the com officer.

"Hm. Let him wait a little longer, then. What's been launched in pursuit of us?"

"Nothing, so far," reported Murka.

Miles's brows rose at this unexpected news. He took a moment to compose himself, wishing he'd had time to clean up, shave, and put on a fresh uniform before this interview, just for the psychological edge. He scratched his itching chin and ran his hands through his hair, and wriggled his damp sock toes against the deck matting, which they barely reached. He lowered his station chair slightly, straightened his spine as much as he could, and brought his breathing under control. "All right, bring him up."

The rather blurred background to the face that formed over the vid plate seemed faintly familiar—ah yes, the Security Ops room at Ryoval Biologicals. Baron Ryoval had arrived personally on that scene as promised. It took only one glance at the dusky, contorted expression on Ryoval's youthful face to fill in the rest of the scenario. Miles

folded his hands and smiled innocently. "Good morning, Baron. What can I do for you?"

"*Die*, you little mutant!" Ryoval spat. "You! There isn't going to be a bunker deep enough for you to burrow in. I'll put a price on your head that will have every bounty hunter in the galaxy all over you like a second skin—you'll not eat or sleep—I'll have you—"

Yes, the baron had seen his freezers all right. Recently. Gone entirely was the suave contemptuous dismissal of their first encounter. Yet Miles was puzzled by the drift of his threats. It seemed the baron expected them to escape Jacksonian local space. True, House Ryoval owned no space fleet, but why not rent a dreadnought from Baron Fell and attack now? That was the ploy Miles had most expected and feared, that Ryoval and Fell, and maybe Bharaputra too, would combine against him as he attempted to carry off their prizes.

"Can you afford to hire bounty hunters now?" asked Miles mildly. "I thought your assets were somewhat reduced. Though you still have your surgical specialists, I suppose."

Ryoval, breathing heavily, wiped spittle from his mouth. "Did my dear little brother put you up to this?"

"Who?" said Miles, genuinely startled. Yet another player in the game . . . ?

"Baron Fell."

"I was . . . not aware you were related," said Miles. "*Little* brother?"

"You lie badly," sneered Ryoval. "I knew he had to be behind this."

"You'll have to ask him," Miles shot at random, his head spinning as the new datum rearranged all his estimates. *Damn* his mission briefing, which had never mentioned this connection, concentrating in detail only on House Bharaputra. Half-brothers only, surely—yes, hadn't Nicol mentioned something about 'Fell's half-brother'?

"I'll have your head for this," foamed Ryoval. "Shipped back frozen in a box. I'll have it encased in plastic and hang it over my—no, better. Double the money for the man who brings you in alive. You will die slowly, after infinite degradation—"

In all, Miles was glad the distance between them was widening at high acceleration.

Ryoval interrupted his own tirade, dark brows snapping down in sudden suspicion. "Or was it Bharaputra who hired you? Trying to block me from cutting in on their biologicals monopoly at the last, not merging as they promised?"

"Why, now," drawled Miles, "would Bharaputra really mount a plot against the head of another House? Do you have personal evidence that they do that sort of thing? Or—who did kill your, ah, brother's clone?" The connections were locking into place at last. Ye gods. It seemed Miles and his mission had blundered into the middle of an on-going power struggle of byzantine complexity. Nicol had testified that Fell had never pinned down the killer of his young duplicate . . . "Shall I guess?"

"You know bloody well," snapped Ryoval. "But which of them hired you? Fell, or Bharaputra? *Which?*"

Ryoval, Miles realized, knew absolutely nothing yet of the real Dendarii mission against House Bharaputra. And with the atmosphere among the Houses

being what it apparently was, it could be quite a long time before they got around to comparing notes. The longer the better, from Miles's point of view. He began to suppress, then deliberately released, a small smile. "What, can't you believe it was just my personal blow against the genetic slave trade? A deed in honor of my lady?"

This reference to Taura went straight over Ryoval's head; he had his *idée fixe* now, and its ramifications and his rage were an effective block against incoming data. Really, it should not be at all hard to convince a man who had been conspiring deeply against his rivals, that those rivals were conspiring against him in turn.

"Fell, or Bharaputra?" Ryoval reiterated furiously. "Did you think to conceal a theft for Bharaputra with that wanton destruction?"

Theft? Miles wondered intently. Not of Taura, surely—of some tissue sample Bharaputra had been dealing for, perhaps? Oh *ho*—

"Isn't it obvious?" said Miles sweetly. "You gave your brother the motive, in your sabotage of his plans to extend his life. And you wanted too much from Bharaputra, so they supplied the method, placing their super-soldier inside your facility where I could rendezvous with her. They even made you pay for the privilege of having your security screwed! You played right into our hands. The master plan, of course," Miles buffed his fingernails on his T-shirt, "was mine."

Miles glanced up through his eyelashes. Ryoval seemed to be having trouble breathing. The baron cut the vid connection with an abrupt swat of his shaking hand. Blackout.

Humming thoughtfully, Miles went to get a shower.

He was back in Nav and Com in fresh grey-and-whites, full of salicylates for his aches and contusions, and with a mug of hot black coffee in his hands as antidote to his squinting red eyes, when the next call came in.

So far from breaking into a tirade like his half-brother, Baron Fell sat silent a moment in the vid, just staring at Miles. Miles, burning under his gaze, felt extremely glad he'd had the chance to clean up. So, had Baron Fell missed his quaddie at last? Had Ryoval communicated to him yet any part of the smoldering paranoid misconceptions Miles had so lately fanned to flame? No pursuit had yet been launched from Fell Station—it must come soon, or not at all, or any craft light enough to match the *Ariel*'s acceleration would be too light to match its firepower. Unless Fell planned to call in favors from the consortium of Houses that ran the Jump-point Station. . . . One more minute of this heavy silence, Miles felt, and he would break into uncontrollable blither. Fortunately, Fell spoke at last.

"You seem, Admiral Naismith," Baron Fell rumbled, "whether accidently or on purpose, to be carrying off something that does not belong to you."

Quite a few somethings, Miles reflected, but Fell referred only to Nicol if Miles read him right. "We were compelled to leave in rather a hurry," he said in an apologetic tone.

"So I'm told." Fell inclined his head ironically. He must have had a report

from his hapless squad commander. "But you may yet save yourself some trouble. There was an agreed-upon price for my musician. It's of no great difference to me if I give her up to you or to Ryoval, as long as I get that price."

Captain Thorne, working the *Ariel*'s monitors, flinched under Miles's glance.

"The price you refer to, I take it, is the secret of the Betan rejuvenation technique," said Miles.

"Quite."

"Ah . . . hm." Miles moistened his lips. "Baron, I cannot."

Fell turned his head. "Station commander, launch pursuit ships—"

"Wait!" Miles cried.

Fell raised his brows. "You reconsider? Good."

"It's not that I *will* not tell you," said Miles desperately, "it's just that the truth would be of no use to you. None whatsoever. Still, I agree you deserve some compensation. I have another piece of information I could trade you, more immediately valuable."

"Oh?" said Fell. His voice was neutral but his expression was black.

"You suspected your half-brother Ryoval in the murder of your clone, but could not chain any evidence to him, am I right?"

Fell looked fractionally more interested. "All my agents and Bharaputra's could not turn up a connection. We tried."

"I'm not surprised. Because it was Bharaputra's agents who did the deed." Well, it was possible, anyway.

Fell's eyes narrowed. "Killed their own product?" he said slowly.

"I believe Ryoval struck a deal with House Bharaputra to betray you," said Miles rapidly. "I believe it involved the trade of some unique biological samples in Ryoval's possession; I don't think cash alone would have been worth their risk. The deal was done on the highest levels, obviously. I don't know how they figured to divide the spoils of House Fell after your eventual death—maybe they didn't mean to divide it at all. They seem to have had some ultimate plan of combining their operations for some larger monopoly of biologicals on Jackson's Whole. A corporate merger of sorts." Miles paused to let this sink in. "May I suggest you may wish to reserve your forces and favors against enemies more, er, intimate and immediate than myself? Besides, you have all our credit chit but we have only half our cargo. Will you call it even?"

Fell glowered at him for a full minute, the face of a man thinking in three different directions at once. Miles knew the feeling. He then turned his head, and grated out of the corner of his mouth, "Hold pursuit ships."

Miles breathed again.

"I thank you for this information, Admiral," said Fell coldly, "but not very much. I shall not impede your swift exit. But if you or any of your ships appear in Jacksonian space again—"

"Oh, Baron," said Miles sincerely, "staying far, far away from here is fast becoming one of my dearest ambitions."

"You're wise," Fell growled, and moved to cut the link.

"Baron Fell," Miles added impulsively. Fell paused. "For your future information—is this link secured?"

"Yes?"

"The true secret of the Betan rejuvenation technique—is that there is none. Don't be taken in again. I look the age I do, because it is the age I am. Make of it what you will."

Fell said absolutely nothing. After a moment a faint, wintry smile moved his lips. He shook his head and cut the com.

Just in case, Miles lingered on in sort of a glassy puddle in one corner of Nav and Com until the Comm Officer reported their final clearance from Jumppoint Station traffic control. But Miles calculated Houses Fell, Ryoval, and Bharaputra were going to be too busy with each other to concern themselves with him, at least for a while. His late transfer of information both true and false among the combatants—to each according to his measure—had the feel of throwing one bone to three starving, rabid dogs. He almost regretted not being able to stick around and see the results. Almost.

Hours after the Jump he woke in his cabin, fully dressed but with his boots set neatly by his bed, with no memory of how he'd got there. He rather fancied Murka must have escorted him. If he'd fallen asleep while walking alone he'd surely have left the boots on.

Miles first checked with the duty officer as to the *Ariel*'s situation and status. It was refreshingly dull. They were crossing a blue star system between Jump points on the route to Escobar, unpeopled and empty of everything but a smattering of routine commercial traffic. Nothing pursued them from the direction of Jackson's Whole. Miles had a light meal, not sure if it was breakfast, lunch, or dinner, his bio-rhythm being thoroughly askew from shiptime after his downside adventures. He then sought out Thorne and Nicol. He found them in Engineering. A tech was just polishing out the last dent in Nicol's float chair.

Nicol, now wearing a white tunic and shorts trimmed with pink piping, lay sprawled on her belly on a bench, watching the repairs. It gave Miles an odd sensation to see her out of her cup, it was like looking at a hermit crab out of its shell, or a seal on the shore. She looked strangely vulnerable in one-gee, yet in null gee she'd looked so right, so clearly at ease, he'd stopped noticing the oddness of the extra arms very quickly. Thorne helped the tech fit the float cup's blue shell over its reconditioned anti-grav mechanism, and turned to greet Miles as the tech proceeded to lock it in place.

Miles sat down-bench from Nicol. "From the looks of things," he told her, "you should be free of pursuit from Baron Fell. He and his half-brother are going to be fully occupied avenging themselves on each other for a while. Makes me glad I'm an only child."

"Hm," she said pensively.

"You should be safe," Thorne offered encouragingly.

"Oh—no, it's not that," Nicol said. "I was just thinking about my sisters. Time was I couldn't wait to get away from them. Now I can't wait to see them again."

"What are your plans now?" Miles asked.

"I'll stop at Escobar, first," she replied. "It's a good nexus crossing, from there I should be able to work my way back to Earth. From Earth I can get to

Orient IV, and from there I'm sure I can get home."

"Is home your goal now?"

"There's a lot more galaxy to be seen out this way," Thorne pointed out. "I'm not sure if Dendarii rosters can be stretched to include a ship's musician, but—"

She was shaking her head. "Home," she said firmly. "I'm tired of fighting one-gee all the time. I'm tired of being alone. I'm starting to have nightmares about growing legs."

Thorne sighed faintly.

"We do have a little colony of downsiders living among us now," she added suggestively to Thorne. "They've fitted out their own asteroid with artificial gravity—quite like the real thing downside, only not as drafty."

Miles was faintly alarmed—to lose a ship commander of proven loyalty—

"Ah," said Thorne in a pensive tone to match Nicol's. "A long way from my home, your asteroid belt."

"Will you return to Beta Colony, then, someday?" she asked. "Or are the Dendarii Mercenaries your home and family?"

"Not quite that passionate, for me," said Thorne. "I mainly stick around due to an overwhelming curiosity to see what happens next." Thorne favored Miles with a peculiar smile.

Thorne helped load Nicol back into her blue cup. After a brief systems check she was hovering upright again, as mobile—more mobile—than her legged companions. She rocked and regarded Thorne brightly.

"It's only three more days to Escobar orbit," said Thorne to Nicol rather regretfully. "Still—72 hours—4,320 minutes. How much can you do in 4,320 minutes?"

Or how often, thought Miles dryly. *Especially if you don't sleep*. Sleep, per se, was not what Bel had in mind, if Miles recognized the signs. Good luck—to both of them.

"Meanwhile," Thorne maneuvered Nicol into the corridor, "let me show you around my ship. Illyrican-built—that's out your way a bit, I understand. It's quite a story, how the *Ariel* first fell into Dendarii hands—we were the Oseran Mercenaries, back then—"

Nicol made encouraging noises. Miles suppressed an envious grin, and turned the other way up the corridor, to search out Dr. Canaba and arrange the discharge of his last unpleasant duty.

Bemusedly, Miles set aside the hypospray he'd been turning over in his hands as the door to sickbay sighed open. He swivelled in the medtech's station chair and glanced up as Taura and Sergeant Anderson entered. "My *word*," he murmured.

Anderson sketched a salute. "Reporting as ordered, sir." Taura's hand twitched, uncertain whether to attempt to mimic this military greeting or not. Miles gazed up at Taura and his lips parted with involuntary delight. Taura's transformation was all he'd dreamed of and more.

He didn't know how Anderson had persuaded the stores computer to so exceed its normal parameters, but somehow she'd made it disgorge a complete Dendarii undress kit in Taura's size: crisp grey-and-white pocketed jacket, grey trousers, polished ankle-topping boots. Taura's face and hair were clean

enough to outshine her boots. Her dark hair was now drawn back in a thick, neat, and rather mysterious braid coiling up the back of her head—Miles could not make out where the ends went—and glinting with unexpected mahogany highlights.

She looked, if not exactly well-fed, at least less rawly starving; her eyes bright and interested, not the haunted yellow flickers in bony caverns he'd first seen. Even from this distance he could tell that re-hydration and the chance to brush her teeth and fangs had cured the ketone-laced breath that several days in Ryoval's sub-basement on a diet of raw rats and nothing else had produced. The dirt-encrusted scale was smoothed away from her huge hands, and—inspired touch—her clawed nails had been, not blunted, but neatened and sharpened, and then enamelled with an iridescent pearl-white polish that complemented her gray-and-whites like a flash of jewelry. The polish had to have been shared out of some personal stock of the sergeant's.

"Outstanding, Anderson," said Miles in admiration.

Anderson smirked proudly. "That about what you had in mind, sir?"

"Yes, it was." Taura's face reflected his delight straight back at him. "What did you think of your first wormhole jump?" he asked her.

Her long lips rippled—what happened when she tried to purse them, Miles guessed. "I was afraid I was getting sick, I was so dizzy all of a sudden, till Sergeant Anderson explained what it was."

"No little hallucinations, or odd time-stretching effects?"

"No, but it wasn't—well, it was quick, anyway."

"Hm. It doesn't sound like you're one of the fortunates—or unfortunates—to be screened for Jump pilot aptitudes. From the talents you demonstrated on Ryoval's landing pad yesterday morning, Tactics should be loathe to lose you to Nav and Com." Miles paused. "Thank you, Laureen. What did my page interrupt?"

"Routine systems checks on the drop shuttles, putting them to bed. I was having Taura look over my shoulder while I worked."

"Right, carry on. I'll send Taura back to you when she's done here."

Anderson exited reluctantly, clearly curious. Miles waited till the doors swished closed to speak again. "Sit down, Taura. So your first twenty-four hours with the Dendarii have been satisfactory?"

She grinned, settling herself carefully in a station chair, which creaked. "Just fine."

"Ah," He hesitated. "You understand, when we reach Escobar, you do have the option to go your own way. You're not compelled to join us. I could see you get some kind of start, downside there."

"What?" Her eyes widened in dismay. "No! I mean . . . do I eat too much?"

"Not at all! You fight like four men, we can bloody well afford to feed you like three. But . . . I need to set a few things straight, before you make your trainee's oath." He cleared his throat. "I didn't come to Ryoval's to recruit you. A few weeks before Bharaputra sold you, do you remember Dr. Canaba

injecting something into your leg? With a needle, not a hypospray."

"Oh, yes." She rubbed her calf half-consciously. "It made a knot."

"What, ah, did he tell you it was?"

"An immunization."

She'd been right, Miles reflected, when they'd first met. Humans did lie a lot. "Well, it wasn't an immunization. Canaba was using you as a live repository for some engineered biological material. Molecularly bound, dormant material," he added hastily as she twisted around and looked at her leg in disquiet. "It can't activate spontaneously, he assures me. My original mission was only to pick up Dr. Canaba. But he wouldn't leave without his gene complexes."

"He planned to take me with him?" she said in thrilled surprise. "So I should thank *him* for sending you to me!"

Miles wished he could see the look on Canaba's face if she did. "Yes and no. Specifically, no." He rushed roughly on before his nerve failed him. "You have nothing to thank him for, nor me either. He meant to take only your tissue sample, and sent me to get it."

"Would you rather have left me at—is that why Escobar—" she was still bewildered.

"It was your good luck," Miles plunged on, "that I'd lost my men and was disarmed when we finally met. Canaba lied to me, too. In his defense, he seems to have had some dim idea of saving you from a brutal life as Ryoval's slave. He sent me to kill you, Taura. He sent me to slay a monster, when he should have been begging me to rescue a princess in disguise. I'm not too pleased with Dr. Canaba. Nor with myself. I lied through my teeth to you down in Ryoval's basement, because I thought I had to, to survive and win."

Her face was confused, congealing, the light in her eyes fading. "Then you didn't . . . really think I was human—"

"On the contrary. Your choice of test was an excellent one. It's much harder to lie with your body than with your mouth. When I, er, demonstrated my belief, it had to be real." Looking at her, he still felt a twinge of lurching, lunatic joy, somatic residual from that adventure-of-the-body. He supposed he always would feel something—male conditioning, no doubt. "Would you like me to demonstrate it again?" he asked half-hopefully, then bit his tongue. "No," he answered his own question. "If I am to be your commander—we have these non-fraternization rules. Mainly to protect those of lower rank from exploitation, though it can work both—ahem!" He was digressing dreadfully. He picked up the hypospray, fiddled with it nervously, and put it back down.

"Anyway, Dr. Canaba has asked me to lie to you again. He wanted me to sneak up on you with a general anesthetic, so he could biopsy back his sample. He's a coward, you may have noticed. He's outside now, shaking in his shoes for fear you'll find out what he intended for you. I think a local zap with a medical stunner would suffice. I'd sure want to be conscious and watching if he were working on *me*, anyway." He flicked the hypospray contemptuously with one finger.

She sat in silence, her strange wolfish face—though Miles was getting used to

it—unreadable. "You want me to let him . . . cut into my leg?" she said at last.

"Yes."

"Then what?"

"Then nothing. That will be the last of Dr. Canaba for you, and Jackson's Whole, and all the rest of it. That, I promise. Though if you're doubtful of my promises, I can understand why."

"The last . . . " she breathed. Her face lowered, then rose, and her shoulders straightened. "Then let's get it over with." There was no smile to her long mouth now.

Canaba, as Miles expected, was not happy to be presented with a conscious subject. Miles truly didn't care how unhappy Canaba was about it, and after one look at his cold face, Canaba didn't argue. Canaba took his sample wordlessly, packaged it carefully in the biotainer, and fled with it back to the safety and privacy of his own cabin as soon as he decently could.

Miles sat with Taura in sickbay till the medical stun wore off enough for her to walk without stumbling. She sat without speaking for a long time. He watched her still features, wishing beyond measure he knew how to relight those gold eyes.

"When I first saw you," she said softly, "it was like a miracle. Something magic. Everything I'd wished for, longed for. Food. Water. Heat. Revenge. Escape." She gazed down at her polished claws, "Friends . . . " and glanced up at him, " . . . touching."

"What else do you wish for, Taura?" Miles asked earnestly.

Slowly she replied. "I wish I were normal."

Miles was silent, too. "I can't give you what I don't possess myself," he said at length. The words seemed to lie in inadequate lumps between them. He roused himself to a better effort. "No. Don't wish that. I have a better idea. Wish to be yourself. To the hilt. Find out what you're best at, and develop it. Hopscotch your weaknesses. There isn't time for them. Look at Nicol—"

"So beautiful," sighed Taura.

"Or look at Captain Thorne, and tell me what 'normal' is, and why I should give a damn for it. Look at me, if you will. Should I kill myself trying to overcome men twice my weight and reach in unarmed combat, or should I shift the ground to where their muscle is useless, 'cause it never gets close enough to apply its strength? I haven't got *time* to lose, and neither have you."

"Do you know how little time?" demanded Taura suddenly.

"Ah . . . " said Miles cautiously, "do you?"

"I am the last survivor of my crèche mates. How could I not know?" Her chin lifted defiantly.

"Then don't wish to be normal," said Miles passionately, rising to pace. "You'll only waste your precious time in futile frustration. Wish to be great! That at least you have a fighting chance for. Great at whatever you are. A great trooper, a great sergeant. A great quartermaster, for God's sake, if that's what comes with ease. A great musician like Nicol—only think how horrible if she were wasting her talents trying to be merely normal." Miles paused self-con-

sciously in his pep talk, thinking, *Easier to preach than practice. . . .*

Taura studied her polished claws, and sighed. "I suppose it's useless for me to wish to be beautiful, like Sergeant Anderson."

"It is useless for you to try to be beautiful *like* anyone but yourself," said Miles. "Be beautiful like Taura, ah, that you can do. Superbly well." He found himself gripping her hands, and ran one finger across an iridescent claw, "Though Laureen seems to have grasped the principle, you might be guided by her taste."

"Admiral," said Taura slowly, not releasing his hands, "Are you actually my commander yet? Sergeant Anderson said something about orientation, and induction tests, and an oath. . . . "

"Yes, all that will come when we make fleet rendezvous. Till then, technically, you're our guest."

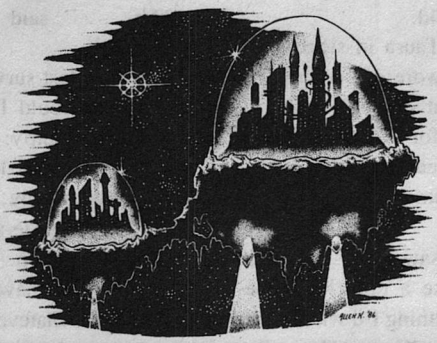
A certain sparkle was beginning to return to her gold eyes. "Then—till then—it wouldn't break any Dendarii rules, would it, if you showed me again how human I am? One more time?"

It must be, Miles thought, akin to the same drive that used to propel men to climb sheer rock faces without an antigrav belt, or jump out of ancient aircraft with nothing to stop them going splat but a wad of silk cloth. He felt the fascination rising in him, the death-defying laugh. "Slowly?" he said in a strangled voice. "Do it right this time? Have a little conversation, drink a little wine, play a little music? Without Ryoval's guard squad lurking overhead, or ice cold rock under my . . . "

Her eyes were huge and gold and molten. "You did say you liked to practice what you were great at."

Miles had never realized how susceptible he was to flattery from tall women. A weakness he must guard against. Sometime.

They retired to his cabin and practiced assiduously till halfway to Escobar. ■



●We believe that to err is human. To blame it on someone else is politics.

Hubert H. Humphrey

Jay Kay Klein's biolog

Lois McMaster Bujold was, like many writers, educated in widespread areas the outpouring of thought from this education has created a synthesis that the rest of us enjoy reading. She has lived in Ohio all her life, holding an assortment of jobs not uncommon to many writers, though she did start out rather lower than most—mucking out a horse barn at age twelve.

Higher formal education came at Ohio State University for four years, with an hors d'oeuvres platter of subjects including English, Education, Biology, Pharmacy, Photography, and History. Several years of working as a pharmacy technician followed until she had her first of two children, and decided to split her efforts full-time between homemaking and writing. A first-sale science fiction short story appeared in 1985. A first *Analog* appearance, her fourth novel, started serially in Dec., 1987, the same year she was runner-up for the Campbell Award as best new writer. Two more novels are appearing from Baen Books this year: *Brothers in Arms* and *Borders of Infinity.*

That first *Analog* story proved so popular that it was one of seven nominated this year by the Science Fiction Writers of America for the Best Novel of 1988. With a science-fiction-reading university professor for a father, and possessed of dual Ph.D.'s in Physics and Electrical Engineering, Lois was probably predestined to write SF, especially since she started reading SF at age nine. Other types of literature came later.

At fifteen, she traveled, with her parents, by car, to Austria, Italy, and France, then hitchhiked through the rest of Europe with her older brother. Accommodations included a park bench in Oxford and a castle in Scotland. In college, she quickly realized she wasn't so much interested in studying literature as in its creation. A liking for wildlife and close-up photography also led to six weeks of photographing insects in East Africa.

Unlike any other profession where close attention to a narrow specialization is the only way to success, writing not only permits one to make use of a melange of wide-spread knowledge but actually demands it. As Lois says, "Nothing is wasted. Even your failures are reclassified as raw material." She did serve an apprenticeship in learning to write, rewriting and retyping until her prose style was whipped into shape. Then, three novels were sold all at once, making her an overnight success after thirty years of buildup. ■

Lois McMaster Bujold

Rick Cook

NEURAL NETS

Imitation may be not only the sincerest form of flattery, but a useful technique for research.

Where are all the intelligent machines?

For as long as science fiction has been science fiction, writers have been telling stories about machines that could talk and move under their own control. By the 1990s we were supposed to have human-like robots, "voicewriters" to replace typewriters, and a host of other wonders.

Many of the early science fiction predictions have come true. We've been to the Moon. Giant airliners carrying hundreds of passengers routinely ply the skies. But no voicewriters, no human-like robots.

Oh, we have robots after a fashion. There are thousands of them at work in factories. But for the most part they are no more than programmable manipulators.

In the same way we have talking machines. You can hear one just by calling information and asking for a telephone number. But the first voice you hear on the line will be a human operator's. The talking machine simply gives you the phone number after the human has found out what you want.

So where are the robots, and the voicewriters, and the rest of it?

In *The Door Into Summer*, Robert Heinlein told the story of an engineer who invented the early robots. There was the Hired Girl, who could clean houses; Window Willie, who did windows; and Drafting Dan, a robot drafting machine. Of the three, only Drafting Dan is with us today.

The reasons for that are instructive.

We don't have Drafting Dan as Heinlein envisioned him. Heinlein's robot was an expanded, automated version of the drafting machines of the time. What we have are Computer-Aided Design (CAD) workstations.

A CAD station is much more powerful than Drafting Dan. Besides blueprints, CAD stations produce electronic files which are more likely to be integrated into a computer database than printed out. From that database other programs can automatically generate parts lists, cost estimates, and control programs for the numerically controlled tools which will make the parts.

But there is a critical difference between a CAD station and Heinlein's Drafting Dan. CAD workstations do it all electronically. They don't move things around in the real world.

The usual explanation for why we don't have robots, voicewriters, and such is that we don't have enough computing power. Heinlein and the other writers of the Golden Age of science fiction had no appreciation of how difficult it is to get a machine to see, the reasoning goes, or how hard it is to allow a robot to move freely in the messy environment of the average home. (How does your cleaning robot tell the difference between a sun-warmed patch of rug in need of vacuuming and the family cat, for instance?)

However that answer is at best incomplete. Our computers have far outstripped the imaginations of the science fiction writers of 40 years ago. No one imagined that we would be able to create computer images you couldn't tell from photographs. They didn't predict that almost everyone in the country would be able to afford a computer many times more powerful than anything in existence before 1955, or that if you wanted you could get it all in a package smaller than a briefcase. No one predicted that most wind tunnel and test work in aviation would be replaced by computer simulations.

A more precise answer emerges when you take closer look at what we can and can't do. What we are missing is less raw computing power than *sensing* power. Our machines think very well. What they can't do is see or hear or even balance all that well.

How hard is it to find a door in a wall? For you, not hard at all. For a robot it is extremely hard. It takes a very bright robot to tell a closed door from a stretch of wall. For that matter it takes a very bright robot just to stand on two legs.

We are the products of billions of years of evolution and much of that has to do with interacting with the outside world. Our machines don't have that advantage. On a good day, our robots can just about match the sensory awareness of a paramecium, and something as simple as an ant has a sensing system

that puts anything we can even conceive of designing to shame.

Note than a "sensing system" isn't the same thing as a "sensor." Sensors are things like television cameras and microphones that accept input from the outside world and translate it into signals the computer can understand. Those we have and in excellent quality. We can see further than an eagle, smell better than an ant, detect motion, sound, pressure, infrared radiation and just about anything else much better than any animal.

But we can't integrate that information. What is lacking is the rest of the system, the parts that take that input and use it to distinguish a door from a wall. We simply can't build sensing systems that can handle balance, vision, hearing, etc., as well as a retarded insect.

The conventional approach to the problems of robotics is to use relatively few sensors and a lot of processing power. We have developed clever algorithms and sophisticated feature extraction processes to let us work around the problems to a remarkable degree. With the limited sensor systems we have, we can achieve truly amazing results.

Of course, those results are a lot like Samuel Johnson's dog walking on its hind legs. The amazing thing isn't that it is done well, the amazing thing is that it is done at all.

Well if *our* methods don't work, why don't we do it the way nature does?

We can't do it in exactly the same way because for one thing we aren't sure how our brains do these things. What we can do is we can take clues from the way neural systems operate that can do the jobs we want.

In their present incarnation we call our representations of these systems "neural nets" and the whole idea "neural computing."

Like "artificial intelligence," "neural computing" is one of those terms that promises far more than we can presently deliver. Doubtless that will come back to haunt us just as the term artificial intelligence is haunting the people who work in that field. But for now it's the accepted term and it's too late in the game to quibble.

We know that neural nets work. We have known that for years. What we don't know yet is whether or not neural nets can do things that are useful in a useful fashion. That is, will they remain laboratory curiosities or will they burst out of the labs to transform our technology and possibly our culture?

There isn't a lot of middle ground. If neural nets prove to be useful and cost effective, their impact can be nothing less than revolutionary. We are talking about something that will have as much effect on our lives as the automobile or the telephone. Home robots are the least of it.

Neural Nets and How They Work

Basically a neural net is a very peculiar form of computer with a very peculiar set of characteristics. So peculiar that if you want to understand neural nets, it helps to know little or nothing about computers. People who know a lot about computers tend to

twitch and mutter when you try to explain neural nets to them.

Functionally, a neural net is best thought of as a pattern recognition device. It does superbly what conventional computers do so poorly: extract features from data and learn to recognize patterns.

"Learn" in this case is exactly the right word. You don't program a neural net, you teach it. You show it thousands of repetitions of the pattern you want it to learn and what you want it to associate that pattern with, and the neural nets learn to make the association.

Not only do neural nets learn patterns, they can generalize. If you have trained the neural net to recognize the letter "U," it can also recognize "u". *U* (script U) or even ⊃ (sideways U). In learning the letter it has extracted the quality of "U-ness" from it and can recognize that quality in many different contexts.

U-ness is an instance of the property of thing-ness (or however you say that in philosophy), the quality that distinguishes one kind of thing from another.

This is a problem that has occupied philosophers at least since the days of Plato. How do we know a chair when we see one?

"Well," you say, "because it looks like a chair."

"What does a chair look like, then?"

"Well, it's got legs . . ."

"Ever seen a beanbag chair?"

"Yeah, but . . ."

"Aren't there dozens of styles of chairs that sit directly on the floor with no legs?"

"Well, yeah, but . . ."

"So describe chairness to me. What's a chair?"

"Wait!" You say triumphantly as the ghost of Alfred Korzybski comes galloping to the rescue. "There's the extensional definition. A chair is what you sit on."

"Fine," I say, smirking and perching on the corner of the table. "What's this?"

At that point no one would blame you if you threw something at me.

There are two lessons here. The first is that the trick to looking smart in a situation like this is to be the one asking the questions. The second lesson is that describing the thing-ness of something is extremely difficult. That is a lesson that workers in robotics and AI have been learning over and over. It is the rock on which teaching a machine to read or listen has floundered for years.

It is very easy to teach a computer to read—as long as it is only presented with one typeface in one size, the letters are spaced precisely on the line and some other rigid criteria are met. Teaching a computer to read the mixture of typefaces and styles in the average magazine—or even the average second-grade reading book—is a much harder proposition.

A neural net isn't so limited. A neural net Optical Character Reader (OCR) can not only recognize letters, it can generalize from what it has learned. To a neural net a U is a U, and it doesn't much matter what the size or style of the type, or how the letters are spaced.

Already the Japanese have built an experimental neural net OCR which is about 99% accurate on recognizing letters.

This neural net OCR demonstrates one of the other characteristics of neural nets. When the Japanese first built it, it was right about 96% of the time. It keeps getting better with use because it keeps learning.

Neural nets supply the missing element for our machines: the ability to interpret the world around them. Given that, we can move computing power off the screens and into the homes and factories in a big way.

Neural nets are not just one thing. They are a whole class of systems. At the present time there are about fifty known types and a dozen or so different neural net architectures being actively explored. In the United States, the most common variety are the back-propagation networks. The Europeans are very interested in another kind of neural net called a Kohonen network. Groups everywhere are looking at other possibilities.

At bottom all neural nets consist of nodes and connections. The nodes are small and not-too-bright computers and the connections tie the nodes together.

Essentially, the nodes only do one job. Based on the input from other nodes they decide whether to fire (pass a signal on to their outputs) and how strong that signal should be. In the simplest kinds of nets, the nodes make that decision by addition. If their inputs from all their connections total to a threshold value, call it 1, then they fire.

To see how this works, let's build a simple neural net. Each node in our net can be thought of as a variable resistor with an inverter. The normal output of the node is a 1, but the resistor and inverter can be used to set the signal voltage to anything from 1 to −1.

The inverter is important because a node's output doesn't have to be positive. In our nervous systems, neurons which inhibit signals are at least as important as ones that pass signals and the same is true of a neural net. In fact, the correct operation of most kinds of neural nets depends on the presence of these inhibitory signals.

From these simple nodes we will build an Exclusive-OR circuit: a circuit that takes inputs on two channels and produces an output signal if either of the inputs is positive, but not if both are positive. This is simple enough to be intuitively obvious and complex enough to be interesting. It has the added property that a digital computer is logically reducible to a mass of XOR gates—as they are known in the trade.

First we establish three layers. An input layer accepts signals from the real world. In an actual neural net these might come from a microphone, an array of photodetectors or a conventional computer. Next comes a hidden layer in which each node is connected to all the nodes above and below it. Finally there is the top, or output layer, which provides the finished product of the neural net's work to the outside world.

Now we wire five of our nodes up as

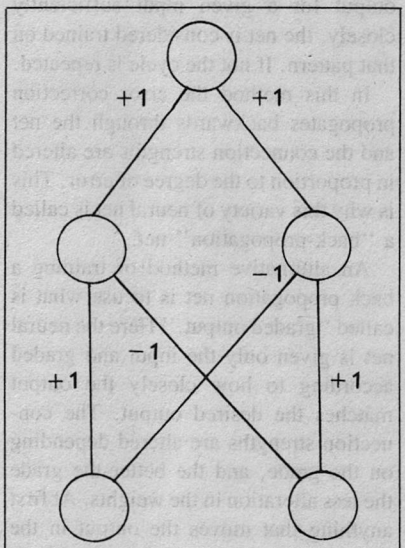


Figure 1: An Exclusive-or Neural Net.

shown in Figure 1. Notice that each node in the bottom layer has connections to both the middle layer nodes. The connection to the node directly above it is positive, while the connection to the other node is negative. The middle layer nodes are connected to the top layer nodes directly above them.

If we apply an input to both nodes in the lower layer nothing happens. Both the lower nodes fire, but each node in the middle layer receives a $+1$ signal from the node beneath it and a -1 signal from the other bottom node. That adds to zero so neither node fires and the top node receives no signals.

If we apply signal to just one of the nodes, however, the node fires, the node above it fires and the top node fires. *Viola!* An Exclusive-OR circuit.

This is about as simple as a neural net can get, but it illustrates several points about the little beasts.

First, there is no central processing unit and no central memory. Information is stored in the strengths of the connections between the nodes and the processing is done by all the nodes working together. When programmed, each node works as a simple switch. The only decision it must make is whether to turn itself on or not.

Second, this example is beloved of neural net people because it effectively disproves one of the major criticisms made against the last generation of neural nets, namely that there were whole classes of problems they could not solve—such as simulating an XOR circuit.

But how does something that simple learn?

Well, that one doesn't, not really. If the nodes in a neural net are as simple as the resistor/inverter combination, the value, or "weight," for each connection has to be set manually to make the neural net function. This is programming, albeit of a very primitive, physical sort.

In a real neural net the nodes are more complex. The principle is the same, but each node is a small computer which can be programmed to make a fairly elaborate decision whether or not to fire. Even more importantly, the nodes are programmed to change their firing criteria depending on the result of previous iterations.

To see how this works, let's look at another neural net model—what is called

a two-layer back-propogation net, or more simply, a "perceptron" net. Our second model is simpler because it only has two layers, an input layer and an output layer. It is more complex because each node can alter its behavior depending on the signals that propogate back to it from the layer above. In effect each node gets scored on its performance in each trial and it can use that score to modify its behavior in the next trial by modifying the weight (strength) of each of its connections.

We start out with the connection strengths between the nodes more or less randomized. (This isn't necessary, but it speeds things up somewhat). Now we present our neural net with an input pattern and the desired output for that input. In this phase neither the input or the output can vary, but the nodes can change the weights of the various connections. In neural net jargon, we "clamp" the input and outputs.

Next we fire the net. The random weight of the connections means that some of the nodes will give exactly the values they should have to produce the desired output. Most of them won't and many of them won't even be close.

Now each node in the output layer does a simple comparison between its desired (clamped) output and its actual output, and sends a signal to the nodes in the input layer telling them to alter the signal strengths to that node (connection weights) to make the output closer to the desired output.

After a series of such trials, the output is unclamped and the neural net is run again. If the output matches the desired output for a given input sufficiently closely, the net is considered trained on that pattern. If not the cycle is repeated.

In this method the error correction propogates backwards through the net and the connection strengths are altered in proportion to the degree of error. This is why this variety of neural net is called a "back-propogation" net.

An alternative method of training a back propogation net is to use what is called "graded output." Here the neural net is given only the input and graded according to how closely the output matches the desired output. The connection strengths are altered depending on the grade, and the better the grade the less alteration in the weights. At first anything that moves the output in the right direction gets a positive grade. In later interactions, the output has to come closer and closer to the desired output to be graded positive.

If you took basic psychology at the right university you will recognize this process. Psychologists call it "operant conditioning." It involves treating the subject, whether a rat or a neural net, as a black box and reinforcing desired behavior. At first you reinforce anything close to the behavior you want and then you reward more selectively as the behavior gets more desirable. If the reinforcement is sufficient, the subject will eventually learn through trial and error. This is only one of many slightly spooky similarities between the animal and neural net behavior.

Spookiness aside, there are two very significant points here. The first is that we did not program the neural net, we

taught it. There was programming to set up the algorithm used by the nodes to decide how to alter the connection strengths, but that had nothing to do with the patterns the net learned. Once the algorithm was provided and the training session started, the net's behavior was self-organizing.

The second point arises from the first. Not only did we not set the connection weights which produced the desired result, *we don't even have to know what they are!*

Unlike a conventional computer, a neural net is inherently non-algorithmic. You can teach a neural net to do something without being able to do it yourself.

We programmed the nodes on how to learn, but we did not supply the method the neural net used to solve the problem and we may not know what that method is. We don't even necessarily know what features the net considers important in recognizing the pattern —although we might be able to determine that by examining the connection weights. The net has not only learned something, it had developed its own rules for learning it. By comparing the output with some feedback and altering the connection weights accordingly, the neural net eventually converges on the desired pattern.

This means we can sidestep the question of what is U-ness and still build a system that knows a U when it sees it. The philosopher wants to know what makes a U a U. The roboticist doesn't really care. All she wants is a robot that can tell the difference beteween a U and a W and do it consistently.

In the past our roboticists and engineers have gotten sucked into the philosophical problem because our computers are algorithmic. In order to program a computer you have to know the method the computer will use to solve the problem. A neural net doesn't need to know your method. It finds its own method as it learns. There is no guarantee that two neural nets will extract the same set of features from a U or a chair. But we can guarantee that if the nets are properly designed and they have been properly taught that they will correctly solve the problem.

Back-propogation nets are only one kind of neural net and we have only looked at a couple of kinds of back-propogation nets. There are many others and they all operate somewhat differently. However, the basic rules behind them are all similar and most of them are equally simple.

The basic rules governing the way neural nets learn may be simple but some of the details aren't. In a back-propogation net like this, for example, we don't try to change the connection weights all at once to make the net give us the right answer on the first try. Remember, each node in the top layer is responding to the sum of all the weighted inputs from the bottom layer and that makes it impractical to alter everything at once.

Instead we program the nodes to alter the connection weights slightly each time and check the new outputs against the desired pattern. Eventually the net converges on the right output pattern

(solution).

The amount by which the weights are altered and the rule for altering them have to be chosen carefully when designing the neural net. A lot of neural net research is concerned with these problems.

For example, as you approach +1 or −1 connection weight, you want to change the strengths more slowly than you do around 0. Large positive or negative values can have major influences on the output layer, sometimes swamping subtle details. You want to approach maximum and minimum connection weight ever more slowly to minimize this effect. Likewise, as you get close to the solution, you want to change weights by smaller increments. Otherwise you might overshoot your solution and have to hunt back.

An added problem is that most layered neural net models are not two-layer nets. A two-layer back-propagation net is inherently limited in the problems it can solve because for some kinds of situations no correct set of weights exist. Try designing an XOR circuit with just two layers of nodes, for instance. It can't be done and it was mathematical proof of that fact which turned AI researchers off on neural nets (called "perceptrons" back then) in the late 1960s.

A back-propagation neural net with three or more layers can solve many more kinds of problems, so most neural nets of this sort are built with one or more middle, or "hidden" layers (as in Figure 2).

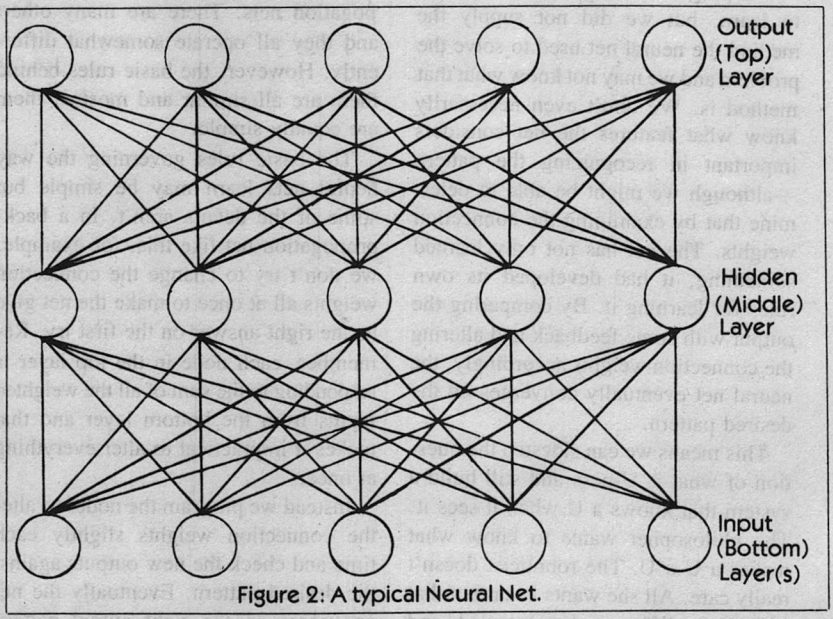


Figure 2: A typical Neural Net.

That's fine, only how does the correction signal propagate through the hidden layers down to the input layer? The connection weights in all the layers have to be altered in order to converge on the proper answer and the simple feedback approach we used in a two-layer model won't work any more.

The answer is both rather complex and less deterministic. Essentially, what we do is introduce a measured amount of randomness into the changes in the connection strengths and reward the changes that move us in the right direction. The nodes in layer N can't know what is happening in layer N-1 or below, but they can see the results and reinforce the lower layer accordingly. That layer, in turn, can reinforce the layer below it.

A Machine that Thinks Like a Man?

One of the other characteristics of neural nets is that they can recognize partial patterns and choose the partial pattern that best matches the one they are searching for. Humans do this all the time, of course. It is how we spot the "U-ness" of a letter U, no matter what type face or size it is.

A neural net can store many different patterns in its connection weights. Essentially, it chooses among them by deciding which of them the presented example most closely matches. It makes that decision on the basis of which output nodes fire. The match does not have to be exact. If more of the nodes representing U fire than nodes representing any other letter, a U it is.

Some conventional pattern recognition systems can recognize a partial example, such as U with its top blocked off. But the further the example diverges from the programmed pattern, the more computing power you need to make the match.

With a neural net, the match is automatic. If it's closest, the pattern is selected. No added computing time, no extra processing. The neural net pattern recognition is inherently fuzzy, just like a human's.

More than that, a neural net's "memory" for stored information is both associative and distributed, like a human's. If a neural net is given part of a pattern, it automatically completes it with the best match in its memory. Give a human part of a pattern ("Who was the guy with pointy ears on 'Star Trek'?") and we also fill in the rest.

This distributed memory has led some people to compare human memory to a hologram. Our work with neural nets suggests that human memory is not holographic at all, although like a hologram, information is massively distributed.

A neural net is much better able to respond to uncertain information than a conventional computer. What's more, with the appropriate programming of the nodes, it gets more accurate over time. It can learn from its mistakes.

There is one other common trick with neural nets that contributes to their power. Some neural nets use a method called "competitive learning." In competitive learning, the successful nodes, the ones that are part of the correct pattern, inhibit the competing nodes on the

same level by sending them a signal telling them to decrease their connection weights. As a result, patterns which have occurred frequently in the past are more likely to be selected out of the competing patterns.

If you stop and think about it, this is pretty much the way our brains work. We organize sense perceptions according to familiar patterns and we can very quickly pick a pattern we know out of a confusing background, especially if we have seen it recently. A number of optical illusions and a lot of the art of camouflage are based on fooling this faculty.

There are a couple of problems here, too. One of them is that if competitive learning goes on for too long, the neural net will produce the same output for everything. The successful pattern completely dominates all the others.

We limit this effect by limiting the maximum connection weights and providing a decay function for the weights. The weights never get so strong they can overwhelm the other patterns, and a pattern which is not presented gets slightly weaker with each trial.

The second, and more subtle, problem relates to the way a neural net stores information. As a rough guide, you need at least one input node for each pattern to be recognized.

That is less of a limit than it seems. A "pattern" in this case can be a rule or general organizing principle as well as an individual item.

However, every instance of the pattern reinforces the pattern. If your universe is composed of a few general patterns and a lot of exceptions, the neural net will go through a phase where the general patterns completely overwhelm the exceptions. After enough repetitions the net will learn the exceptions, but for a while they will be consistently misclassified.

This has strong parallels in human behavior. One example is learning past tenses in English.

For years researchers have known that young children go through three stages in learning the past tense of verbs. In the first stage they know only a few common past tenses, divided between regular (look/looked) and irregular (see/saw) verbs. In this stage children tend to use the past tenses correctly whether the verb is regular or irregular.

In the second stage, the child uses many more past tenses, but regular verbs predominate, as they do in English in general. However irregular verbs tend to be given regular endings (see/seed, sleep/sleeped). This is true even of irregular verbs the child used correctly in the first stage. In learning the general rules for past tenses, the child temporarily loses the ability to recognize the exceptions to these rules.

In the third and final stage, the child knows even more verbs and tends to form the past tense correctly. Not only that, but the child can usually form the past tense correctly for verbs it has never seen before.

If our brains act like neural nets with competitive learning, this makes excellent sense. A child begins by learning past tenses as separate words, about equally divided between regular and ir-

regular verbs. Gradually enough examples are acquired to let the child recognize the pattern to past tenses. But because there are so many more regular than irregular verbs, the child tends to overgeneralize and the irregular past tenses are suppressed. In the final stage, the child acquires enough examples of irregular verbs to be able to recognize them as separate cases, and also the general rules for forming past tenses.

Researchers tested this hypothesis by building a neural net and teaching it past tenses. It followed the learning pattern of a child, right down to the finer points, such as the way it learned various classes of irregular verbs.

The correspondence between the way a neural net acts and the way humans act can be downright bizarre. Some neural nets need "sleep," periods when they are left on but no inputs are presented. If they aren't allowed to sleep they start hallucinating—giving output when there is no input—the way a sleep-deprived human does.

One group of researchers in England had a neural net they were testing on very simple inputs. Eventually the net's behavior became erratic and then it quit working entirely. The researchers concluded the net was bored with the simple stimuli.

The Future of Neural Nets

Does this imply that neural nets are the true path to artificial intelligence? Can we build a truly intelligent machine using neural nets?

Perhaps, but not right away. For one thing, we can't build a neural net complex enough. The human brain contains tens of millions of neurons and our largest neural nets to date only have a few thousand. For a variety of reasons it is going to be extremely difficult to actually build (as distinct from simulate) a neural net with hundreds or thousands of nodes. Even simulating a 100,000-node neural net is very, very hard today.

Most neural nets today are simulations. It is much easier to simulate a neural net on a conventional computer than it is to try to wire one together—or worse yet, build one on a chip. If we ever do get to the stage where we want to build neural net chips of a useful size, we are going to face some intensely furry fabrication problems.

There are theoretical problems as well. An intelligent neural net would have to be huge and terribly complicated. There are theoretical reasons to believe that an intelligent neural net would be so complex we could never understand it.

Nor are neural nets ever likely to replace conventional computers. Like human beings, neural nets are very good at some problems that computers choke on, and wretched at problems that computers find simple. A neural net number cruncher, for instance, doesn't make sense. You could build one, but it would be a slow, clumsy way to handle numerical problems.

However neural computing can supplement our current computers. We can build neural net "front ends" to help computers in any job that requires pattern recognition.

Already a few applications have been

found for neural nets. A company called BehavHeuristics of Silver Spring, MD, has an application to aid airline reservation systems. Nestor Inc. of Providence, RI, is finishing an application to evaluate mortgage insurance applications.

Dealing with the real world is one of the largest areas of interest. Much of the work there is underwritten by the military and hence classified, but neural nets have been used to analyze sonar signals to find submarines and recognize aircraft. A company called Global Holonetics Corp. of Fairfield, IA, is using neural nets to help inspect parts. Banctec Inc. in Dallas, TX, is underwriting research to develop a system to read handwritten numbers on checks. A prototype should be running by the time you read this and it is supposed to be in use by the summer of 1989.

Like any new technology, neural nets are rapidly being oversold. Even if they prove out it will take time for the appliations to take hold and even more time for us to get a sense of what these things can really do.

Hype aside, if neural nets work they will be revolutionary. They offer our best hope for breaking the barriers that have kept computing power confined in CRT tubes. With neural nets we can move our computers off our desktops and out of the carefully controlled factory environments and into our lives.

I'm not sure I'm ready for a voice-writer. I've spent years on keyboards and my ideas take shape as they flow through my fingers onto the screen.

But I would flat *kill* for a robot that would clean up the mess in my office. ■

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The Alternate View

THE MOUSE THAT BOOMED

John G. Cramer

Perhaps, as many science fiction writers have suggested in their writings, our galaxy is populated by advanced civilizations that go about their business in the "downtown" area near the center of the galaxy and can't be bothered to communicate with technologically and culturally unsophisticated rubes that, like the human race, reside far out in the galactic boondocks. If this is the way things are, it may be hopeless to search for such civilizations, as SETI researchers have been attempting to do, by trying to receive their radio messages. A better way to do a SETI search might be to look for detectable radio-wave by-products of the activities of alien civilizations.

SETI scientists have done this by looking for the equivalent of television signals that might emanate from the planet of a civilization that uses radio-wave broadcasts as we do. They have found no evidence of the equivalent of our radio/TV signals in our galactic neighborhood, but that result is inconclusive. Galactic civilizations may be so different or so far ahead of us that they don't use radio waves to communicate. Or perhaps it's just that TV-watching is incompatible with advanced intelligence.

In any case, we need a less culture-dependent way of searching for advanced civilizations. So let's turn our attention from communication, which may be quite culture-dependent, to transportation, which should be more universal. It seems very likely that any advanced space-faring civilization would on occasion need to transport material objects from one star system to another for colonization, exploration, or trade. This would require a starship moving through space at a high velocity.

Even given a worm-hole transport system like that described in my recent AV column (*Analog*, June '89), it would still be necessary to carry one worm-hole portal by starship to a distant location before the wormhole could be used for faster-than-light transport. Advanced space-faring civilizations will inevitably need to move mass from one place to another, and it seems reasonable that this will be done at the highest speed permitted by available resources (energy, reaction mass, . . .). As it happens, massive objects moving rapidly through most regions of our galaxy will leave radio waves in their wake that may be detectable.

Consider a supersonic jet airplane flying overhead. Even if the plane's engines were completely silent, the plane's passage would be apparent because of the *sonic boom* it produces, the shock wave left in its wake because it is traveling faster than about 0.3 kilometers per second, the speed of sound in air. The shock wave phenomenon is not lim-

ited to high-performance jet planes. A motorboat traveling faster than the wave-speed on the water surface leaves a vee-shaped wake that is also a shock wave. A fast charged particle traveling through transparent plastic at a speed that exceeds the speed of light in the plastic medium (perhaps 60% of the speed of light in vacuum) makes Čerenkov radiation, a kind of optical shock wave. And a massive body traveling rapidly through our galaxy should make a plasma shock wave that may produce detectable radio waves.

In most regions of our galaxy the "empty" space between the stars is not empty at all; it is occupied by a *plasma*, a very thin gas of ionized hydrogen atoms and free electrons. Any traveling pressure variation (or sound) moves through this plasma in much the same way sound waves move through the air. The molecules of air are electrically neutral, however, and to transmit a sound wave the molecules must physically bump together, requiring close contact. The analogous components of a plasma, ions and electrons, have electrical charges that can act over large distances, so they can jostle one another with their electric fields while they are well separated. Because of this difference, the speed of sound is very much greater in a plasma than in air.

The actual speed of sound in a plasma depends on its temperature, which is related to its degree of ionization. A "hot" plasma (temperature 10^6K) such as might be found near the center of the galaxy has a sound velocity (**S**) of about 100 km/sec or 3.3×10^{-4} of the velocity of light (**c**). A "cold" plasma (temperature at 10^4 K) like that to be found in our galactic neighborhood has a lower sound velocity of **S** at 10 km/sec or 3.3×10^{-5} **c**. In either case any object moving through the plasma at a speed faster than **S** will produce a shock wave in the plasma medium, and this in turn will generate very characteristic and possibly detectable radio waves.

The shock wave or "bow shock" has a characteristic vee-shape like the wake left in the water behind a speedboat. The shape of the bow shock provides a kind of speedometer for objects moving faster than the speed of sound **S**. The opening angle Θ of the "vee" (measured center-to-edge) is related to the speed **V** of the object by the relation: $\mathbf{V} = \mathbf{S}/\text{Sin}\ \Theta$. For example, a bow shock making an angle of $\Theta = 30°$ (remember that Sin $30° = 1/2$) means that $\mathbf{V} = 2.0\ \mathbf{S}$, and so an object making a 30° bow shock is traveling at twice the speed of sound. This relation is independent of which medium is involved.

In the case of a plasma shock wave, the acceleration of electrons in the plasma by the shock generates radio waves by the process called *synchrotron radiation*. Such radio waves are easily recognized because they have a distinctly non-thermal spectrum of frequencies and are strongly polarized. Therefore, to the extent that a massive object moving through the interstellar plasma energizes a bow shock, we have a method of looking for any interstellar space vehicle that moves faster than the speed of sound in the local plasma. We simply look for the radio waves from its "sonic boom."

Have such radio waves ever been observed? As a matter of fact, radio waves from the bow shock of a rapidly moving

galactic object have recently been discovered and reported in the journal *Nature*. The object making the waves has the catchy name of **G359.3-0.82**. Not satisfied with this designation, its discoverers, Farhad Yusef-Zadeh of NASA's Goddard Laboratory and John Bally of AT&T's Bell Labs, have nicknamed their discovery *the Mouse* because of its mouse- or tadpole-like shape. The Mouse's radio image shows a symmetric conical body trailing a tail which, viewed with 6 cm radio waves, shows a steady decay of surface brightness along its 12 arc-minute length.

Yusef-Zadeh and Bally discovered the Mouse while using the Very Large Array (VLA), an interferometer array of large radio-telescope dishes located on the desert near Socorro, New Mexico, to study the radio waves coming from the center of our galaxy. They used the VLA because of the excellent angular resolution that it can provide. The Mouse, located in the line of sight toward the center of our galaxy, is in the constellation Sagittarius at right ascension 17h 44′04″ and declination -29°◯ 57′05″ in the southern sky. Its radio image is not far from that of a prominent ring-like supernova remnant radio source, **G539.2-05.**

Determination of the distance of objects observed is often a difficult problem in astronomy, and is particularly so for unusual objects like the Mouse, that cannot be referenced to standard stars and cannot be observed visually because of the dust that obscures our galactic center. Since the radio image of the Mouse is located near the supernova remnant **G539.2-05**, which is established to be near the center of the galaxy, Yusef-Zadeh and Bally have suggested that the Mouse is associated with **G539.2-05** and is therefore the same distance from us, some 27,700 light-years (or 8,500 parsecs) away. While this distance assumption is reasonable, it has not yet been verified by independent consistency checks. The Mouse *could* be much closer, lying anywhere along the line of sight between us and the center of the galaxy.

The Mouse exhibits the polarized non-thermal radio spectrum expected from bow shock synchrotron radiation. As measured from head to extreme tail, it shows an opening angle of about $\Theta = 10°$, which corresponds to **V** = 5.8 **S**. That means that if the Mouse is located in the hot plasma of the galactic center, it is moving through that plasma with 5.8 times the speed of sound, 580 km sec or 0.2% of the velocity of light, and making a sonic boom as it goes. This makes the Mouse unique. No other astrophysical object in our galaxy has ever shown evidence of such a high velocity relative to its surroundings.

The quantity or energy in radio waves in the 1.4 GHz band received from the Mouse is about 2 Janskys (2×10^{-26} watts m^2-Hz), a very large energy flux considering the distance of the object. If the Mouse lies at the galactic center, it is continuously emitting about 10^{25} watts of energy as radio waves. The length of the wake, given that distance, implies that it has been radiating at about that energy level for perhaps the past 26,000 years. Yusef-Zadeh and Bally speculate that the very strong power plant of the Mouse may be a rapidly rotating neutron star. They suggest that it might be a former member of a

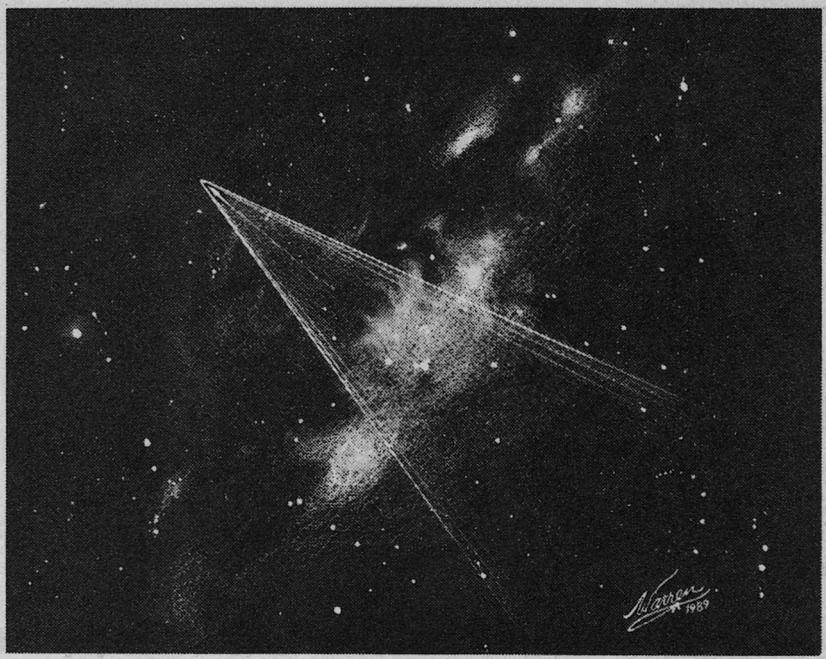

Illustration © 1989 by William R. Warren, Jr.

binary star system that has been propelled to a high velocity by the supernova explosion of its binary companion. However, the actual physical processes that could accomplish this are unclear, and there is some skepticism that this scenario can work. The Mouse is a mystery.

Readers of this magazine should by now be wondering if the Mouse could be an alien starship. If the distance scale suggested by Yusef-Zadeh and Bally is correct, the answer is *no*. The Mouse would have to be a star-size object with star-class energy output and a huge kinetic energy that could only have been produced in some ancient cataclysm. But there remains the possibility that its discovers are wrong about how far away it is.

Perhaps the Mouse is much closer, maybe only a few dozen light-years distant, and it just happens to lie along the line of sight leading to the galactic center. In that case, to account for the energy reaching us, the energy output of the Mouse would be only about 10^{19} watts, equivalent to direct conversion of matter to energy at the rate of about 100 kilograms per second. Such energy generation, though inconceivably large by contemporary standards (10^{10} watts is the output of a very large nuclear power plant), might be within the capabilities of an advanced civilization.

Because the local plasma is cooler and its sound velocity slower than that near the galactic center, the velocity of the object would also drop if it was close by in our galactic neighborhood. The

speed of the Mouse would be only about 58 km/sec or 0.02% of light speed. The required duration of its energy output, based on the length of the wake, would drop to about 200 years, long enough to have traveled about 0.04 light-years during that period. Starship Mouse would be expending a huge amount of energy for a long time while not getting very far.

Is the Mouse *likely* to be an alien starship? Of course not. In astrophysics the hypothesis that "little green men" are producing a new astrophysical phenomenon is always tempting; remember the discovery of pulsars. But a reasonable and plausible explanation involving only natural processes has, up to now, always been found. Probably this will also be true for the Mouse. A reasonable mechanism for producing its large velocity will be worked out.

But someday, if there is intelligent life in the Universe, the "little green men" explanation will have to be used. Because someday we will observe an astrophysical phenomenon that has been produced by an alien civilization.

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●With increasing distance our knowledge fades, and fades rapidly, until at the last dim horizon we search among ghostly errors of observations for landmarks that are scarcely more substantial. The search will continue. The urge is older than history. It is not satisfied and it will not be suppressed.

Edwin Hubble
Submitted by John Hradsky

●If the arm that wields the sword wants to do something truly useful, it can lend a hand with the ploughing.

G.M. Ross

futures

Matthew J. Costello

Raise your hands if you *don't* know someone who owns a Nintendo Entertainment System.

You see, I know lots of people who have the N.E.S., what the software trade calls a "dedicated game machine" (i.e. it does only one thing—play games.) And they *all* know that I get review copies of games. At first it wasn't so bad. But now everyone wants the latest Nintendo game from me prontissimo, just as soon as I'm done with it. (And if one of my dear friends is reading this, don't worry. I don't mean *you*. It's the *rest* of the video game fanatics who are driving me crazy.)

And I feel some responsibility for all this mayhem. In some small way, we helped usher in this new age of video games by writing one of the first feature reviews of the system, which Nintendo reproduced en masse for their press kits. The rest, as they say, is history.

This new age video explosion has only grown. The recent software hall at the Consumer Electronics Show was more of a love fest for Nintendo and its 30 plus licensees. And, surprisingly enough, there are new products for Nintendo that should increase interest.

The big news was a remarkable gadget produced by Broderbund Software Inc. called the *U-Force*. This show-stopper is a compact device, the size of a loose-leaf notebook, that lets you play Nintendo games with no controller. Driving a car? Just put out your hands and tool away. Fighting Mike Tyson? Just punch at the air and watch Mike duck and dive. The *U-Force* carried the promise of real interactive games one step further. And while Broderbund isn't saying how the machine works, it senses your body motions and speed. It can be set up in a number of ways to accomodate different games. Best of all, the price is not astronomical—a suggested price of $70.

Another hot new technology for Nintendo is remote joysticks. Accolade's remote features a controller of about the same size as the traditional Nintendo controller. Beeshu offers a full-size remote joystick with buttons on either side of the stick for the benefit of left or right handed players. There are also suction cups to hold what Beeshu calls the Ultimate Superstick, in place.

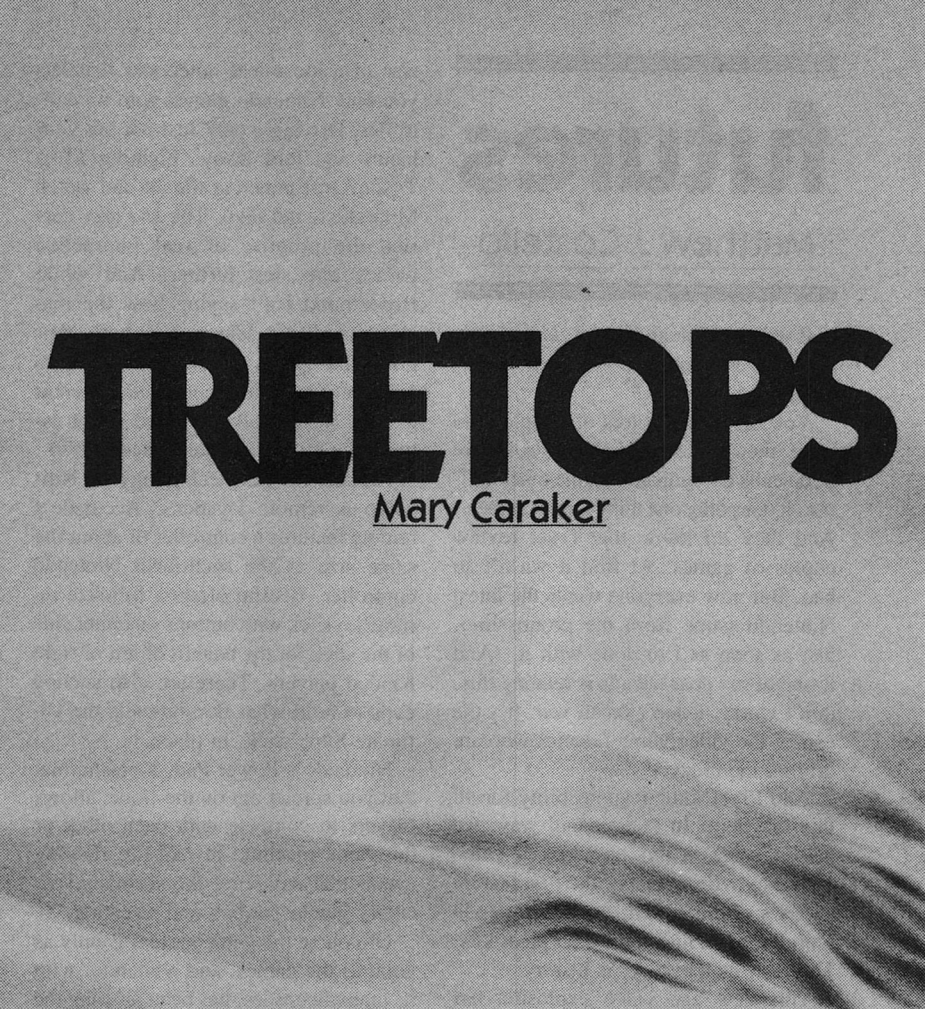
Nintendo's Power Pad, a plastic mat that you spread out on the floor, allows players to compete with each other or the game machine in real-life running events that will leave the normally sedentary gamer panting and sweating.

Of course the game system is only as good as the games, and Nintendo, with its many licensees, has been pushing the limits of the video game. *The Adventures of Link* is Nintendo's follow-up to its million-plus seller, *The Legend of Zelda*. *Link* adds a role-playing feel to the successful arcade adventure, with characters you can talk with, more extensive maps, and gameplay that favors strategy as well as collecting handy

(continued on page 174)

TREETOPS

Mary Caraker



Cultural barriers can be high and hard to surmount. But professional colleagues have an advantage. . . .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The flitter deposited Morgan at the camp and took off again immediately. Alone on the landing platform, she walked uneasily to its edge and peered down into the trees.

Vertigo assailed her, and she gripped the rope rail tightly. Below, leafy foliage in a variety of shapes and hues obscured her view to the forest floor, but she knew what lay there. She was suspended three hundred feet above a gas-emitting swamp roiling with poisonous algae.

"Don't think about it," said a voice that she recognized at once. A sun-helmeted head appeared on the opposite side of the platform as Bernard Kraskolin, tall and lean and darkly handsome in a fresh khaki bush suit, pulled himself up from a ladder.

"It's good to see you again," he said. He offered a handshake.

Morgan had looked forward to a warmer greeting. So that's the way it's going to be, she thought. But what could she expect—it had been five years.

"I put in a special request for you," he said. "It's a delicate situation here, and you're the only Corps teacher I could trust to handle it. I'm glad you accepted."

Morgan wasn't sure how glad she was. She and Kras had been lovers once, on another steamy jungle world. The thought of renewing their relationship was one of the main reasons she had agreed to come to Frontera, where Kras was in charge of the SEF contact team that was making an initial study of the newly discovered planet.

It began to look to Morgan like a bad mistake. Especially when she had to climb down the ladder herself and on to a swaying walkway that led into the crown of another group of trees.

"You'll get used to it," said Kras as he navigated the unsubstantial structure with ease, while carrying Morgan's duffel.

Morgan gripped the guide ropes and refused to look down. When they were safe on another solid platform, this one roofed and sided to form a comfortable room, she expelled a tightly held breath. This would be her fourth Space Corps assignment, and she had been on some odd worlds, but at least she had been able to keep her feet on *terra firma*. Living in trees would be a new experience.

It was what she had wanted — adventure and new horizons — when she had chosen a career in the Corps, the teaching arm of Space Exploratory Forces. Space Corps teachers had to be tough and adaptable, and unsqueamish when it came to the sometimes peculiar aliens who requested their services.

Morgan had learned tolerance toward a variety of forms, but whatever toughness she had acquired didn't show. At thirty-one she was slender and clear-eyed, and her sense of wonder had never left her.

It came to her rescue now. "A tree house!" she exclaimed. "I always wanted one when I was a kid." She inspected the simple housekeeping arrangements: the hammock bed, the chair fashioned from stout branches and vines, the gourd water bowl.

"We've tried to bring in as few off-world products as possible," Kras said. "To avoid contaminating the native culture." He put down Morgan's bag. "This will be your house, but you can

settle in later. Come along now and meet the others." He led the way out and along another walkway that connected three tree-sitting huts similar in size to hers. "Christina and I are in the first one—we'll be your neighbors. Ben and Fiona Wilder have that middle one—they're doing the xenology study—and on the end is our botanist, Hansi DeGroot. The geology teams have their base a ways from here, where there are no natives to get curious about the equipment. But come on in, they're all expecting you."

He ushered Morgan into the first hut, and before she even had time to wonder about who Christina could be, she was being introduced to her. "My wife. My bride, actually. We were married just after I accepted this posting, so it's really our honeymoon trip."

Christina smiled and offered a white, manicured hand. She was small and fragile-looking, with delicate features and pale blonde hair that she wore long and loose, hanging to her waist.

Morgan had recently cropped her own hair, and she felt decidedly unfeminine by comparison. "Morgan Farraday," Christina murmured. "Bernie's spoken often about you. It was on Parth, wasn't it, where you were both stationed?"

Christina's gaze appeared innocent of any suspicion. Kras beamed and placed a proprietary arm around his tiny wife. "It's Christina's first time away from Earth," he said. "We met at the Academy, where I was giving a course."

"Oh, were you in training there?" Morgan asked. Christina didn't have the look of an SEF specialist, but then some people didn't think that Morgan did, either.

"No, I . . . I was just living there," Christina said.

"Her father is one of the directors," Kras explained. "It's why she was able to come with me." He winked. "Influence in high places."

"And the rest of us are just common workhorses," said a heavyset man with a bushy red beard. "Hansi DeGroot, pleased to meet you." He crushed Morgan's hand in a huge paw.

The other two members of the team came forward also. Ben and Fiona Wilder had the look of long-time partners who had grown to resemble one another—both thin and dark and quick-moving. Once the introductions were all made, the six sat down, on floor mats, to a cold lunch of field rations enhanced by fresh fruit.

"Go ahead." Hansi urged a round, green plum-like shape upon Morgan. "It's perfectly safe. I'm testing the tree fruits as fast as I can, and I'm finding a surprising number of them non-toxic. The Fronterans live in a veritable garden."

Morgan took a bite and found it bitter but not unpalatable. "Tell me about the Fronterans," she said. "All I know is that they're simian, intelligent but primitive, and their language is untranslatable without a voder."

"Even with the voder, it's difficult," Ben Wilder said. "We've programmed it with the usual vocabulary, but it hasn't been able to determine half of their equivalents. We have to guess at what we get. That's why we put in such an urgent request for a teacher. They'd been asking for one for some time, but we couldn't figure out what it was they wanted."

"Do you know *why* they want a teacher?" To Morgan it seemed an odd request, for a culture at the bottom of the scale. "Maybe they aren't as backward as you think."

"That's what we're hoping you can discover for us," Kras said. "You've got a knack with aliens, and you know enough to proceed cautiously. I didn't want any brash do-gooder type going in and offering a lot of uncalled-for help and information."

"Oh, we all know better than that," Morgan said. " 'Teach them only what they ask for.' It's drummed into us from our first Academy lecture."

"All the same," Kras continued, "I wanted someone here I could trust. I'm afraid we're already into a 'cargo-cult' situation."

Morgan knew what he meant: primitive natives who considered their more advanced visitors to be emissaries of gods, if not gods themselves. "How did it happen?" She looked around the hut, which was only slightly better furnished than her own. "You certainly don't show any outward evidences of technology. Nothing they could consider supernatural, or want for themselves."

"We've tried not to," Fiona answered. "But they've seen the flitter, and our clothing, and the lights we have at night. They must have seen us building the camp. At first they were afraid and kept away, but now we find them watching us all the time."

"And there were the presents, of course," Hansi said. He glared at Christina. "Colored beads, can you believe it?"

Christina flushed. "I didn't know. I was just trying to be friendly."

"Of course she didn't know," Kras said. The arm went back again, protectively. "Anyway, what they want from us isn't more beads. Morgan, when do you want to go out and meet them?"

Morgan wiped the last dribble of sticky juice from her chin. "How about right now?"

"I'll take you," Fiona offered. "They have a settlement not far from here."

Outside, at the end of the walkway, Fiona indicated a ladder leading farther down into the trees. "It's easier traveling on the next level, though it's considerably warmer. That's why we built our camp up here."

A cooling breeze ruffled Morgan's hair. The walkway swayed, but she felt less nervous than she had before. As she looked out over the undulating green mass that was the top of the forest canopy, it appeared to her almost as a false floor. It rose and fell in hills and valleys, the tree crowns touching one another and joined by ropy vines. She could imagine it as solid, and herself quite safe, as long she didn't think of the deadly swamp so far below.

The view was wide in all directions. Above, the immense reddish sun dyed the sky with shades of mauve and coral, and the clouds were tinged with fire. To the east, a dark mountain spewed puffs of purple steam.

"The whole planet is actively volcanic," Fiona said. "Most of it is uninhabitable. This jungle"—she stretched her arm to indicate the vast green blanket—"appears to be the one exception. Come on: you'll see how well the Fronterans have adapted."

Morgan followed her down the ladder, which was fastened to a tree trunk

at least six feet in diameter. As the leafy roof closed in upon her, she was in another world. The air was warmer and moister, the light dimmer. Penetrating shafts of sunlight illuminated brilliantly colored flowers and what looked like giant pineapples growing along moss-covered branches. She passed dark recesses and backlit leafy chambers where more aerial plants grew in profusion. Around her head buzzed a myriad of flying insects.

"Don't take your hands off the ladder," Fiona warned. "You might disturb a nest of Lord knows what kind of crawlies. Hansi's found hundreds."

Morgan heeded the warning and descended carefully. Fiona stepped off the ladder onto a broad branch marked with a guide rope. "Natural walkways," she said. "The Fronterans have their own highway system, and we can use a lot of it." The branch was over a foot wide, with what looked like a traffic channel on its upper surface: a soft carpet of moss, with the bromeliad growths on either side. Fiona grasped the rope and started off along the branch. "We strung these, for ourselves," she said of the rope. "The Fronterans, of course, don't need them."

They followed a branching network of the mossy tree trails, some wide as a ground footpath, others so narrow that Morgan hesitated to entrust them with her weight. "Go ahead," Fiona encouraged as Morgan paused before one. "Hansi's tested them all, and he's heavier than any of us."

Morgan stepped out gingerly, but she also kept a firm grip on the rope. She couldn't see into the depths of the abyss below her, but she had a good idea of what awaited her if she should fall.

"You'll get used to it," Fiona said. She ran as nimbly along the branches as if she were only three feet from a safe landing.

Morgan's travel uniform was soon sweat-stained. Fiona wore shorts, and Morgan wished she had taken the time to change. She also wished, as a bug flew into her nose, that she had worn her insect veil.

Fiona was bare faced, but she had smeared on repellant. Morgan had, too, but perspiration had removed most of it. She hoped they hadn't much farther to go.

Fortunately, Fiona stopped soon and motioned Morgan to stand beside her in a wide tree crotch. She removed her voder from her backpack and slung it around her neck. "Over there." She pointed through the leaves, to what looked to Morgan like an enormous hanging basket.

A brown face peeped over the side. Surrounded by a ruff of white fur, it was in the humanoid mold: two large, dark eyes, a flat nose, a curving mouth. The creature reached up with a hairy arm to the suspending vine and swung itself easily out of the basket. Erect on the supporting branch, it was about four feet tall. Brown hair covered its body except for the stomach and the back of the hands, where the hair was furlike and white, like that of the face ruff. It had a long tail that hooked for support on a nearby branch.

Fiona spoke into the voder. "Greetings." She pointed to Morgan. "Teacher. No-tail teacher. You wanted, and she is here."

A guttural babble issued from the voder. The alien answered with a warble of its own, then disappeared with a flying leap into the trees.

Fiona fiddled with the voder, then snapped it off. "He was too far away—I didn't get any of that. But he'll be back. We just have to wait."

There were no more guide ropes between the women's tree and the one with the basket. They were at the edge of Fronteran territory, Morgan guessed. "I hope we're not expected to fly through the trees, too," she said.

"No, they'll take us safely, if they decide to let us in. Sometimes they do, and sometimes not."

"Tell me what I ought to know," Morgan said. "Quickly. I don't want to mess up."

"There's not much. Ben and I have mostly just watched them from here, through the scope. We've seen them gathering food, weaving, building platforms. Very simple tools. Family groups, apparently monogamous. No natural enemies except a few unpleasant insects."

"And the swamp."

"Yes. We've seen them go down occasionally, to gather something, but generally they stay on this level."

Fiona fell silent as three Fronterans, slightly larger than the one Morgan had first seen, approached hand over hand through the branches. They stopped near the two women, and Fiona held out the voder as one started to speak.

"Come, teacher, yes, yes," the voder translated. "Teacher come see, teacher talk. Teacher come alone."

"It looks like I'm not wanted," Fiona said. "Do you think you can handle it? They won't hurt you, I can assure you of that."

"It's what I'm here for," Morgan said. She trusted Fiona, and in any case, she had her finger-needle loaded.

"I'll wait for you, then. But try not to be more than an hour." Fiona gave her the voder, and Morgan stepped forward.

The largest of the Fronterans grasped her arm. He was clearly an adult male, with a two-pronged penis visible beneath his body hair. A long keloid scar from what appeared to be a burn ran up one of his muscular legs. He wore a waist belt of woven vines that held a knife-like implement, and around his neck dangled a string of glass beads.

His healed wound did not impair him; he guided Morgan with agility along branchways that she would never have attempted alone. His fingers, she saw, contained gripping pads, as did his toes and the end of his muscular tail. When they came to an open space, he encircled her with one arm and his tail and swung so quickly across on a hanging liana that she had no time to be afraid.

The other two Fronterans disdained the vine and bridged the gap with powerful leaps. They said something to Morgan's guide and then sped on ahead, their hands and feet barely seeming to touch the branches.

They were out of sight in seconds. Morgan glimpsed several more of the hanging baskets, and the mossy branch she traversed with her guide had a well-worn traffic channel.

The channel widened until they stepped from it onto a platform of stout poles laced together with vines. It had a roof of woven leaves, but no walls. Half a

dozen Fronterans squatted around a small fire contained in a bowl, and they regarded Morgan with uniform, dark, probing gazes.

Morgan's guide released her, and he slipped back into the trees. Morgan nervously activated the voder and spoke into it. "Greetings," she said, imitating Fiona. "I am the teacher."

She held out the voder as a warble issued from all six mouths. "Praise, praise, praise," the mechanical voder voice repeated. "No-tail teacher welcome. No-tail teacher teach praise." There was something that sounded like "fire," then "mountain" and a great deal of the beeping that indicated no translatable expression.

Morgan squatted, too, to bring herself to a friendlier level, but the Fronterans only moved back uneasily. First mistake, she thought, and rose to her feet again. "How may I help you?" she asked.

The voder warbled and beeped, and the Fronterans looked at one another in apparent puzzlement.

Morgan tried again. "How may I teach you? Do you have children . . . young . . . little ones"—she measured with her hands—"that I can teach? My people," she gestured again, "the no-tails, we teach them when ours are young."

The voder translated most of the speech, to the increasing distress of the Fronterans. They threw back their heads and howled, and one of them covered the firebowl with a perforated lid. He warbled something at Morgan, waving his hands, and all six disappeared into the surrounding foliage.

"Go, teacher go," the voder droned, translating the last speech.

Morgan shut it off. Sure, but how do I do that, she thought. She could never find her way, unaided, back to Fiona.

The covered fire began to smoke, and Morgan grew increasingly panicky. She saw no movement in either her tree or the surrounding ones, but she had the feeling that she was being watched. Fiona had said that the aliens wouldn't harm her, but the xenologist hadn't heard that howling. . . .

Morgan moved to the edge of the platform. The branch that she had traversed so easily with her guide now looked anything but safe. There were no handholds but only hanging vines, and beyond it was the bridgeless chasm.

No, she preferred to face the Fronterans's anger. She stepped back, only to be stopped by the firm grasp of her former guide. He warbled something and propelled her out along the branch.

They followed the same route back to the tree where Fiona waited. The Fronteran deposited Morgan and left immediately.

"That was fast," Fiona said. "What did you find out?"

Morgan grimaced. "Nothing. I'm afraid I made a mess of it, after all. I was thrown out."

"What did you say to them?"

"Not very much." Morgan didn't feel like analyzing it now. "We can replay it, back at the camp. Maybe you and Ben can figure it out."

This time Morgan followed Fiona easily along the branchways, her hand resting only lightly on the guide rope. They climbed the ladder into the open sky and the cool air of the camp.

Fiona took the voder. "I'll start working on this right away. Want to come help?"

"After I've cleaned up a bit." At least she would wash her face, Morgan thought. Perhaps even a bath—she had seen what looked like a rain-collector behind her hut.

Christina called as Morgan passed her open door. "Please come in—just for a minute."

Kras's bride was sitting on the floor painting her toenails. "I've been so bored," she complained. She wore a wraparound sarong printed with bright flowers, and her hair looked newly washed. "Are you busy? Everyone around here always is. Everyone but me."

"Well, I was going to take a bath and listen to the voder tape with Fiona. Why don't you go over there? She can probably use your help, too."

"Me? Help?" Christina laughed, mirthlessly. "All she'd want me to do is stay out of her way."

"Where is Kras?" Morgan asked. She couldn't help feeling a bit sorry for Christina.

"Oh, he's with Ben, in a big conference. I'm not welcome there, either.

"And I can't even take a walk by myself! Only as far as the landing platform, back and forth. I'm not allowed to go down into the trees. Unless—would you go with me? It's days since I've been away from this camp, and I'm going absolutely stir-crazy!"

Why not? Morgan thought. She was already dirty, and the bath could wait. "I'll change into cooler clothes." She looked pointedly at Christina's sarong. "Maybe you'd better—"

"Of course I will!" Christina jumped to her feet. "I'm not quite as dumb as everyone thinks."

Both women wore light trail clothing and insect-veil hats as they descended into the canopy. This time Christina led the way, along a roped path that zigzagged in the opposite direction from the one Morgan had taken with Fiona. "I'm not allowed anywhere near the Fronteran settlement," Christina said, "Not since I gave them those beads." She shrugged. "I still don't see why it was so awful. I know the Fronterans like me. See"—she pointed above, to a white-bearded face peering through the foliage. "They always follow me, whenever I'm down here. I'd like to talk to them, but Fiona won't let me. Bernie, either. But then, he doesn't want me to do anything but sit in the hut."

"I'm sure he's just thinking of your safety," Morgan said. "You're not trained—"

Christina frowned. "Please. I must have heard that a hundred times." She reached up to examine a cluster of red-petaled airplants. "I could help Hansi with his cataloging. I'd even ride in his sling—I wouldn't be afraid."

"Sling?"

"Come on; I'll show you."

They proceeded to an area where the trees grew farther apart. In one gap Hansi hung suspended below the level of the branches in a pulley-controlled harness. "He's studying the lower growth," Christina said. "It all changes as you approach the swamp."

Hansi saw them, waved, and raised himself up. "Care to have a look?" he invited Morgan. "It's a different envi-

ronment down there. A completely different ecosystem.''

''In that contraption?'' Morgan shuddered. ''No, thank you.''

Christina opened her mouth to say something, but closed it again. Reading her face, Morgan felt another surge of sympathy.

''Time to pack it in, anyway, for today,'' Hansi said as a large raindrop splashed on his head. Others followed, and he climbed out of his harness and joined the women.

The canopy protected them from the worst of the downpour, but the walkway branches quickly became treacherously slick. They made their way back with caution, to a camp that trembled under the full onslaught of the storm.

Morgan toweled herself dry in her hut, and decided that she didn't need a bath after all. Kras entered without knocking.

''Hey!'' She held up her shirt to cover herself. ''Haven't you heard about—''

He waved her protest aside. ''Never mind that. Christina came in soaked. I don't like her down in the canopy at all, and especially not when it's raining.''

Morgan calmly finished dressing. Clearly, he had no eyes for her. ''It wasn't raining when we started out,'' she said. ''And I was with her all the time.'' Talk about overprotective, she thought. Kras hadn't been like that with her, on Parth. But then, she wasn't blonde and petite. And neither did she have important parents.

She banished the last thought as unworthy; Kras looked genuinely concerned. ''Did you see any Fronterans?'' he asked.

Morgan nodded. ''One.''

''A group of them started up here, just before the rain. Ben saw them. It's odd, because they don't like the camp. Too open, I guess. Anyway, the storm scared them off, but we can expect them back when it stops. Which shouldn't be too long.''

Already, it was lessening. Kras left, and Morgan made herself a cup of coffee on her camp stove. By the time she was drinking it, outside, the sky was clear again except for the purple steam clouds around the volcano.

A hairy head appeared, coming up the ladder. ''Kras, they're here again,'' Morgan shouted as she ran down the walkway to greet the Fronterans.

Kras came out of his hut, as did Ben and Fiona and Hansi. The three Fronterans stood uneasily near the top of the ladder. One of them carried a baby.

''Greetings, welcome,'' Ben said into the voder.

The Fronterans ignored him and moved toward Morgan. The one with the baby held it out and warbled something that ended with a wail.

''Take. Teacher take,'' the voder said amid beeps. ''Teacher take, teacher (beep, beep) mountain.'' The alien looked in the direction of the volcano. ''Praise, praise, make safe.''

He held the baby out to Morgan again. When she didn't respond, he laid it at her feet and broke into an earsplitting howl. He withdrew the knife from his belt and waved it above the infant.

Morgan screamed, and Kras grabbed the Fronteran's arm.

Ben held out the voder. ''No, no,'' Morgan said into it. ''I will take the child. You must not harm it.'' She

picked up the tiny form and held it to her.

All three Fronterans began to howl as they edged back toward the ladder. "I can't control the mountain, if that's what you want," Morgan said, but she couldn't make herself heard above their shrieks. The voder beeped, then repeated, "Sorrow, sorrow, sorrow."

The Fronterans disappeared down the ladder. The baby whimpered and wet on Morgan, and Kras groaned. "They think we can turn off the volcano! Morgan, what did you tell them, anyway?"

"She asked about their young," Fiona said. "She tried to explain that we teach the young. Obviously, 'teach' has a different connotation for them. I think they see Morgan as some kind of a priestess, and the child is a gift—a sacrifice—to stop what they believe to be an imminent eruption."

They all looked toward the mountain. "There *has* been more steam lately," Ben said.

"The geology teams haven't reported anything," Kras said. "But I'll give them a call. In the meantime—Morgan, you'd better return that baby."

"It's too late," Hansi said. "She'll have to wait until morning now." He turned to Morgan. "We don't go down after dark." The red sun was already halfway below the horizon, and as it sank, night fell with astonishing rapidity. The colors of sunset were brief, and the volcano cloud glowed for barely a minute before it, too, was cloaked in black.

"So what am I supposed to do with this?" Morgan cradled the baby and hushed its whimpering. It had only a thin coat of hair and a tiny tail, and looked much more human than its adult counterparts.

Fiona cooed and clucked over it. "I'll take care of it," she volunteered, "if you don't want to."

Morgan held it closer. "No, they gave it to me. But . . . do you know what it can eat?"

"Yes," Fiona said. "Well, anyway, I think so. Come on—I'll help you with it."

The two women retired with the baby to Morgan's dimly lit hut, where they were joined by Christina. They offered their tiny guest a variety of mashed fruit, which it refused. After they had each had a turn rocking it, it went to sleep in a bed of towels and dirty laundry.

Kras came in with Ben. "I talked to the geo team. They say—"

"Shhh!" Morgan pointed to the sleeping child.

"I'll stay with it," Christina whispered eagerly. "You can go talk somewhere else."

Kras lit the way with his beamer to his own hut. Inside, he switched on a glowglobe and the four arranged themselves on the floor.

"The volcano's stable," Kras said. "There's no evidence of any new activity."

"But if it *did* erupt," Morgan asked, "would we—and the Fronterans—be in any danger?"

"No. According to the team that's been studying it, it's too far away. The last volcanic residue, they say, is over a hundred years old, and that outbreak didn't touch the forest."

"Then why are the Fronterans such nervous Nellies?" Fiona wondered aloud.

"I think we misunderstood them

again," Ben said. "They didn't want Morgan to turn off the mountain, just to . . . worship it . . . on their behalf. I think the volcano must be pretty awesome to them, and we're connected with it in some way."

"The team found some interesting minerals near the site of the last eruption," Kras said. "Geode crystals that look a lot like those beads Christina gave the natives. And they've seen us coming in the flitter from that direction. It's not hard to imagine what they thought."

"I still wonder why they asked for me," Morgan said. "How does the voder define 'teacher?' "

Fiona answered. "One who knows. One who gives knowledge."

"One who knows," Morgan repeated, musing. "You were probably right earlier about my being seen as some kind of a priestess. Perhaps there's a counterpart in their tribe—a wise person; a shaman. Has anyone ever asked if *they* have a teacher?"

Ben shook his head. "We haven't had much opportunity for long conversations."

"Well, we've got to set things straight," Kras said. "If SEF decides on a base here, they'll need a working relationship with the natives. We can't have them thinking we're volcano gods." He stared reproachfully at Morgan. "And you haven't helped. You should never have taken that child."

"I had to," Morgan protested. "That crazy knife-waver would have killed it."

Kras shook his head. "He probably thought you wanted it already sacrificed. They didn't seem any happier when you took it alive. You should have explained that you didn't want it at all."

"I couldn't! You were there—all that noise. There was no time to explain anything." Morgan glared. Kras had no right to blame *her*.

"It's one damnable mess," he said. "In the morning, all three of you see what you can do. Return the baby. Try to make contact. Hell, you're supposed to be experts. You ought to be able to convince them that we're a bunch of poor, flesh-and-blood sods not much different from themselves."

"We'll try," Ben said. He rose to his feet. "I'm going to work on the voder some more. It's got a good enough sample of their language that we ought to be getting better translations. Maybe there's a damaged circuit."

Fiona followed him out, and Morgan rose to leave, too. She had no wish to be alone with Kras, and he apparently felt the same. "Send Christina home," he said. "I hope you didn't let her hold that baby. I don't want her exposed to anything."

Morgan didn't tell him how Christina had crooned over and cuddled the tiny Fronteran. She found her cradling it again when she reentered her own hut, and had a hard time persuading her to leave it.

Alone, watching the baby, Morgan could appreciate how Christina had felt. She thought of her own rootless life, and almost regretted her choice of a career. She had seen something similar in Fiona's eyes when she had held the baby, and in Christina's there had been pure hunger.

There was no place in the Corps for motherhood. Marriage, maybe. Fiona

and Ben had managed it. Morgan had thought once that it might even come to something permanent with Kras, but now she saw what a laugh that was.

He was such an SEF man, everything by the books. Five years ago, he had been different. At least, it had seemed so then.

Five years, Morgan thought. As far as the two of them were concerned, it could have been a lifetime. And she had fancied love as the one thing you could trust. . . .

She wondered now if he had really cared for her at all. More likely it had been nothing but propinquity: she had been the only young and halfway attractive human female on Parth.

It wasn't a pleasant possibility to consider. The baby squealed, and Morgan calmed it with a stroking hand. When she withdrew her touch, it began to thrash. She finally took it with her into her hammock, where they both slept fitfully, awakened every few hours by the far-off howls of the Fronterans.

In the morning, as soon as the forest was dry from the night rains, Ben and Fiona came to get Morgan. The women made a final attempt to feed the baby, and again it spit everything out.

However, it was active, and lusty in its cries. "I don't think it's suffered any," Fiona said. "Anyway, it'll be back to its mother soon."

Morgan made a carry-sling from a towel, and they filed on to the walkway.

Christina came to her door. "Do you want to say goodbye?" Morgan asked, holding out the baby.

Christina shook her head. Her eyes were swollen and red-rimmed.

"I can guess what went on in there last night," Fiona whispered when they were past. "What they talked about, I mean."

Morgan could, too, but she told herself that it was no business of hers. Christina should have known what she was giving up when she agreed to accompany her husband to a primitive outpost.

Kras was waiting at the ladder. "I've been watching through the scope," he said, "and there's a lot of activity in their part of the forest. You should be able to make contact." He nervously clenched and unclenched his fingers. "What about the voder, Ben?"

"I couldn't find anything wrong."

"Then . . . just do the best you can." He clapped each of them in turn on the shoulder. "Good luck."

In the understorey branches Ben took the lead, followed by Morgan with the baby and then Fiona. "Kras is really uptight about this, isn't he?" Morgan observed.

"Yes, he is," Ben agreed. "But it's understandable—he's got a lot riding on how we succeed. It's his first command, you know. And his father-in-law got it for him. If he fails, he could lose more than his job."

"It wouldn't look good for any of us," Fiona added.

The baby struggled in the sling, and Morgan concentrated on keeping her balance. When they arrived at the tree crotch, in spite of what Kras had said, there were no signs of any watching Fronterans.

Ben pointed to the hanging basket. "If they don't show themselves, we'll have to put the baby in there."

Morgan didn't like the idea. "Will they find it?"

"Don't worry," Fiona assured her. "They all sleep in those things, and the young live there until they're strong enough to go out on the branches."

The branch with the basket was wide and sturdy, but there were no guide ropes. Morgan eyed it dubiously.

"I'll do it," Ben offered.

Morgan hesitated. "No, it should probably be me." She searched the foliage again. "They may be spying on us, and I'm the one they gave the child to."

The others didn't disagree, and Morgan started out before she could have second thoughts. She scrambled into the other tree easily enough, but on the basket branch she soon reached the last handhold.

Fear froze her.

"You're doing great," Ben encouraged. "Just a few more feet."

It looked like a mile to Morgan. Somehow she managed to straddle the branch and then to inch her way along it. She refused to look down, or even to think about what she was doing. When the baby bounced, her mind went numb.

Time stopped, too. Eventually, after what could have been minutes or hours or years, she was over the basket.

It was a good five feet square—no chance to miss. "In you go, Junior," she croaked, and lowered the sling.

The baby tumbled in safely.

Ben and Fiona cheered. "Now come back slowly," Ben said. "The worst is over—this will be easy."

"Easy, is it?" Morgan muttered through clenched teeth. Painfully, now, she wriggled her way back. When Ben reached out to help her to her feet, she was too weak to stand.

She rested in the tree crotch, recovering.

"Here comes Mama," Fiona whispered. A chirruping female dropped onto the branch from above and swung herself into the basket. It swung wildly for half a minute, then became still.

The three humans waited for almost an hour before another Fronteran appeared. He hung from a vine above them and jabbered, and the voder translated. "No-tail teacher say (beep, beep) tree-people young. No-tail teacher not want tree-people young. No-tail teacher say what (beep, beep) mountain want. What want? What want?"

He waited, repeating his "what want?" warble every few seconds.

"Explain that we don't come from the volcano," Ben whispered. "Try, anyway."

Morgan, however, had another idea. "Teacher," she said. "Your teacher. No-tail teacher wants to talk to tree-people teacher."

The voder warbled, and the Fronteran disappeared. Fiona grinned. "A teachers' conference, eh? This I've got to see!"

Morgan would have welcomed Fiona's company, but when the messenger returned she was once more taken alone. This time she was deposited upon a smaller platform that had a single occupant—a wizened female with thin legs and a ruff that was more yellow than white. The alien wore two necklaces: one of Christina's glass beads and the other of what looked like polished seeds and bits of bone and wood. She

was tending a steaming pot suspended above a fire, and from time to time she added bits of leaves and pinches of powder. Her hands and forearms, Morgan noticed, sported several of the keloid scars she had seen before.

The Fronteran female paid Morgan no notice. Odd medicinal odors wafted from various small baskets suspended from the roof, and a pungent one from the pot. Morgan coughed, and the Fronteran whirled and uttered an angry, harangue-like warble.

The voder translated: "Why you come, mountain no-tails? You go back, stay (beep, beep) mountain." She pulled the glass beads from her neck and threw them at Morgan's feet. "Take. Take back, mountain."

Morgan started to say that they didn't come from the mountain, but the angry female gave her no chance. Another long warble produced a chorus of voder beeps, then, "Trouble, you bring trouble. Want baby. Return baby. What you teacher want?" More beeps and then, "Trouble, trouble."

Morgan ignored the question of what she wanted and did her best to convey that they came from far beyond the mountain, from a place where there was no swamp, few trees and they walked on the ground.

The Fronteran stared disbelievingly.

"You are a teacher," Morgan said. "I am a teacher, like you." Best to avoid all mention of children, she decided. "We can teach each other."

However the voder translated the speech, it didn't please. The Fronteran turned her back on Morgan and returned to her steaming pot. She grunted a few times, deep in her throat, but whatever it meant the voder could not pick it up.

The guide came back and waited.

"Another failure," Morgan reported to Ben and Fiona. "I don't think I got anything across about who we are. And what's worse—now they want us to leave."

"Kras will be . . . disappointed," Ben said.

Fiona snorted. "To put it mildly."

Morgan dreaded giving the news, but when they ran into Kras and Hansi at the foot of the ladder, the team captain had other matters on his mind than their report. "Did you see Christina?" he asked at once. He was tight-lipped and white-faced.

"Why, no," Fiona replied. "What's the matter—is she missing?"

"She's not at the camp. I was hoping she was with you. Damn! What could she be thinking of? She knows better than to come down here alone!"

"How long has she been gone?" Morgan asked.

"I don't know—it could be hours. I was with Hansi, looking at some new edible epiphytes he found yesterday. When I went back to our hut, she wasn't there."

Morgan thought he was overreacting, but she didn't say anything. They divided into search teams, the Wilders together and Morgan with Hansi and Kras. "Let's go to that rope sling of yours," Morgan said to Hansi. "It's just a hunch, but—"

Kras turned paler. "She'd never try to use that. Not in a million years. Not Christina."

A lot you know about her, Morgan thought. Kras continued to protest, but

he followed Hansi and Morgan. They called, intermittently, but there was no answer; nothing but Ben's voice calling fruitlessly and the occasional howl of a Fronteran.

Hansi reached the sling first. "Hurry!" he shouted. "I think she's here; there's been an accident."

Someone was in the sling, but one of the ropes had slipped from the pulley and the occupant was dangling so far down as to be out of sight. "My God, she's in the swamp," Kras gasped.

Hansi was already at the pulley. "No, the safety's on and the rope's still tight. I think it stopped in time. Help me, you two—we can get her up."

Crouched on the branch, they managed to get the rope back into the proper groove. Hansi turned the wheel and the mechanism creaked and began to lift its burden.

"God, why doesn't she answer?" Kras worried. Morgan didn't like the prospects either, especially when the sling came into view with its occupant limp and apparently lifeless.

Christina was breathing, but too woozy from the swamp fumes to speak, when they lifted her from the harness. Her legs, from mid-thigh down, were covered with a thick, foul-smelling green slime that bubbled as if it was alive.

Ben and Fiona came, and they rigged a litter from branches and vines and clothing and carried Christina back to the camp. Hansi, who was the team medtech, washed her legs, but the swamp algae had already begun their pernicious work. Where shoes and socks had provided no protection, the skin was a blistered, peeling, oozing pulp.

"It's caustic," Hansi said. He applied nulbac powder and burngel with gloved hands. "This won't really help," he warned. "The poison's still there, and I don't know of anything that will neutralize it. It's eating away her flesh, and it won't stop until—" He looked away and wouldn't finish.

"We've got to get her out of here," Kras said. "We've got to get her to a medical facility. Morgan—that ship you came in on?"

She shook her head. "It just came out of hyperspace long enough to shuttle me here. It was going straight on to the Beta Hydri system."

"We're stuck, then." Kras was ashen as he turned to Hansi. "Can't you . . . excise out the poisoned tissue?"

"I wouldn't dare. I'm not a surgeon."

They all stared helplessly at one another.

Christina retched, opened her eyes and moaned. Hansi prepared a hypo of painkillers, and she subsided into drugged unconsciousness. *She's going to die*, Morgan thought. *Horribly*. And there wasn't anything they could do.

Not them, anyway. Morgan suddenly had a flash of a notion. A possibility. She remembered the healed burns she had seen on several of the Fronterans. And the old female's baskets of forest products with their apothecary shop odors. Maybe it was crazy, but what had they to lose?

Hansi seconded her suggestion. "They would know about phytochemicals," he said. "They would have learned to use them." Even Kras agreed it was worth a chance.

Please, please let it work, Morgan

prayed as they carried Christina back into the trees.

The Fronterans came when Morgan called, and made clucking noises over Christina's legs. Morgan made her request, and they transported the litter, along with Morgan and Kras, to the female with the scarred hands.

"She fell into the swamp," Morgan said into the voder. "Can you help her? Can you heal her legs?"

The Fronteran examined Christina, then looked up at Morgan and warbled. It seemed to Morgan that she wore a look of smug satisfaction. "Why you teacher not do?" the voder translated. There was a series of beeps, then, "You teacher, why you not fix? Why you not fix?"

Morgan spread her hands. "I can't do it. I don't have the knowledge." She adopted a pleading attitude. "You must help us. I ask it. I beg it. My people, the no-tails, we beg it."

The old one bent over Christina again and touched the burn-gel. She warbled angrily, and the other waiting Fronterans scurried about the platform and into an adjoining tree, fetching bowls and water and piles of leaves. Morgan and Kras kept out of the way.

The assistants washed Christina's legs again, in a green liquid with an astringent odor, while the old healer-female mixed a paste in another bowl. She shooed the others away and applied it herself, encasing the legs completely. Then she wrapped them with layers of wet leaves, tying them loosely in place.

"She seems to know what she's doing," Kras whispered. "I just hope it works on humans, too." Morgan had been watching Christina's breathing, and she crept up to feel her pulse.

It was weak but steady. "Will she live?" she asked into the voder. "Will her legs heal?"

The voder warbled, and the Fronteran held out her own hands as she answered. The smug smile appeared again. "Many times (beep, beep) swamp poison," the voder voice said. "Many times heal. Tree-people teacher know. Tree-people teacher know what no-tail teacher not. Yes, yes. This teacher fix hurt no-tail. Hurt no-tail be well."

"Can we take her away now?" Kras asked. "Can you come with us, back to our camp, to take care of her?"

The translation brought a sudden change of mood: hoots and a staccato, angry warble that the voder could not translate.

"Bad suggestion," Morgan guessed. "She'll have to look after Christina here."

"Ask her if I can stay," Kras said.

Morgan did, explaining that Kras was the patient's mate.

The healer refused. "You stay," she said to Morgan through the voder. "You say before, we teach. You, me. I say yes."

The Fronteran clearly relished her superior status, and Morgan had no objection to her being in control. It was better for the humans' purposes to be underdogs than to be gods. "What do you want me to teach?" she asked.

"Everything," the voder said. "Everything you no-tail know."

Morgan walked with Kras to the edge of the platform. "I really think that Christina is in good hands," she said.

"The scars you can always take care of later."

"Of course," he said. He waved his guide to wait. "Morgan, I . . . I want to set something straight with you."

She waited while he searched for words.

"I know how cold I must have seemed to you at first. After what we'd been to each other. I just want you to know that it's because I was afraid."

"Afraid?"

"Of my old feelings. That they might be revived, which wouldn't be fair to Christina. Of course, as usual, I went too far. I hope I didn't hurt you."

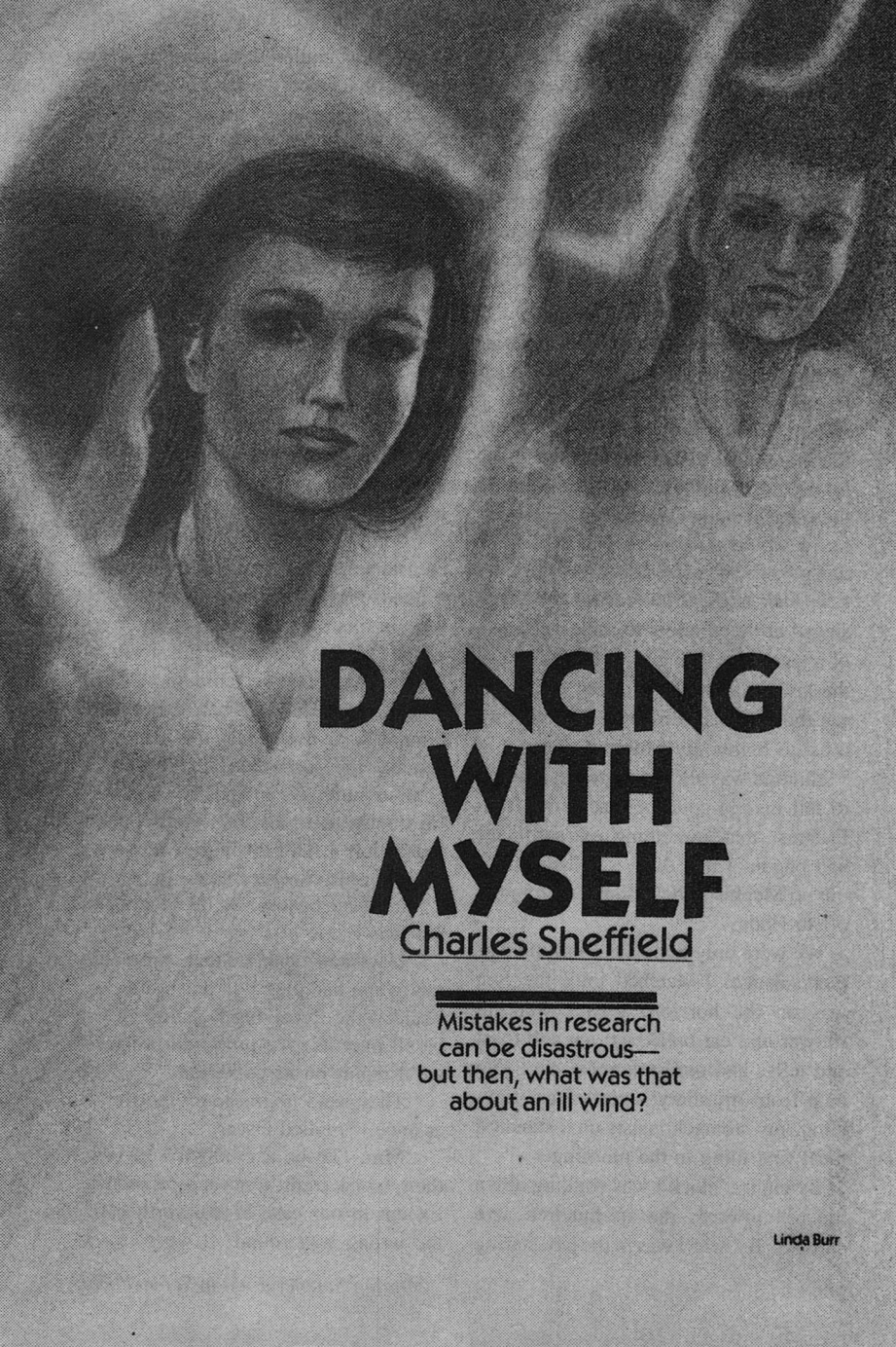
"You didn't," she lied. At least, he *had* cared, once. Right now, she had no time for such matters. She was a teacher again, with the granddaddy of all commissions, and she'd better figure out how in the universe she was to begin. ■

IN TIMES TO COME

● David Hardy's September cover is a first for Linda Nagata. It illustrates her story "In the Tide," which considers a novel approach to the problems of mining such cluttered regions of space as the asteroid belt and the Jovian satellites. Obviously working in such places means working in a space suit, with all the awkwardness appertaining thereunto—or does it? Given genetic engineering, might it be possible to come up with a worker who doesn't *need* a spacesuit? If you do, to what extent is that worker "human"?

Jerry Oltion and Lee Goodloe have an impressive novella that turns the problem of adapting to an unfamiliar environment around. Most of us would have a lot to learn before we could function in space, but somebody who grew up there would have her own problems on a visit to Earth—especially in some of its more interesting environments. Rafting the Colorado, for instance. . . .

Our September issue will also offer a new "Windrider" story by Eric Vinicoff, and a variety of other stories by such writers as Kevin O'Donnell, Jr., Amy Bechtel (who wrote last year's very popular "The Circus Horse"), and Julia Ecklar (well known as a folk singer and composer). Plus an article by Ian Stewart called "Dicing with Death in the Solar System," about an application of chaos theory to a field commonly thought of as too orderly to need it.



DANCING WITH MYSELF

Charles Sheffield

Mistakes in research can be disastrous—but then, what was that about an ill wind?

Linda Burr

A diary has its uses, even if it is the sort of random, fragmented, fill-it-out-two-days-late sort of diary like mine.

For instance, from my official work log I know that the second phase began seven months ago today. But only from my personal diary can I deduce that on that morning I woke up well before dawn. "Mylanta. Time runs, the stars move still, the clock will strike . . ." say my useful notes. And then, without any separating punctuation, "Nicotiana smells heavenly."

With this sort of assistance, I know that I got up suffering from indigestion, looked at the clock, and then went to the open window. And having got that far, I would guess that I heard a pre-dawn whisper of waking birds in the three oak trees at the end of the yard, stayed at the window to seek a glimpse of a raccoon padding thoughtfully across the lawn, and looked for but could not see the dark red blossoms of flowering tobacco below my bedroom window.

But that was all. No portents, nothing to tell me, in spite of that quote from Faustus, that something extraordinary had begun. I had done a hellish thing, but no Mephistopheles came to drag me off to Hades.

We were only two days short of summer solstice. I watched until the Sun was on the horizon, then I went to shower and eat breakfast: tea and toast and jelly, and one scrambled egg. (No help from my diary; unless I am traveling, my stomach insists on a standard meal first thing in the morning.)

By eight o'clock I was walking down the hill towards the six-hundred acre campus. By 8:15 I was in the lab, staring at the new equipment, most of it uncrated, that lined the room's walls.

"Good morning, Alison," said Oscar Horowitz's voice from the lab's inner recesses. "I've had the same worry. We thought we wanted it all these years. Now we've got it we're not sure."

Oscar could see me, but I couldn't see him. I walked back to where he was tucked away in his own corner, behind a row of reagent racks and a gunmetal file cabinet.

"Good morning, Oscar."

We had shared three thousand good mornings, so when he stood up I assume that I looked at him with no particular interest.

I don't think anyone, under any circumstances, would call Oscar Horowitz a handsome or an attractive man. He was in his late thirties, badly overweight, and in deplorable physical condition. I had never seen him move faster than a walk. His dark hair had already thinned to a frizzy mat that could not conceal the scalp beneath despite ingenious combing, and he had a fondness for donuts that most mornings (but not today) left a faint dusting of powdered sugar on his cheek or chin.

He was no beauty. On the other hand, nor was I.

"If we don't uncrate that chromatography unit and plug it in this morning," I said, "the Receiving Department will be all over us. We promised last week we'd report on its condition."

"They send us too much, too much at once," replied Oscar.

"Mm. 'To be a prodigal's favorite, then, worse truth, a miser's pensioner.' Except in our case Wordsworth had it the wrong way round. If we were *ac-*

customed to new equipment we'd take all this in our stride and ask for more.''

''I'll unpack it.'' Oscar put down his coffee cup. ''In fact, I'll do that right now. It's my turn.''

When two people share a small lab and neither is senior to the other, peaceful coexistence is best guaranteed by strict alternation of duties. Oscar was right, it was his turn. I had taken delivery, just two days earlier, of a new microtomy and staining system that neither one of us knew how to use. I didn't feel like fighting more manufacturers' manuals, and in any case I had a nine o'clock class.

I nodded appreciation and walked on back to my own desk, hemmed in by three tall bookcases. The mail had already been delivered. My ''in'' tray held the latest issues of two monthly journals, plus five preprints that I had requested.

I sat down, riffled through one of the journals for a few seconds, and reflected on the changing status of the Biology Department. As recently as three months ago, the university had refused to subscribe to this journal, arguing that it was expensive and only one faculty member had the slightest interest in its contents. Now, anything that Oscar or I ordered was on our desk within a few days.

The winds of change, or maybe of fear. For four years Oscar and I had submitted proposals to the National Science Foundation and the National Institute of Health, and seen our requests refused outright or squeezed down to a hardly useful pittance. Small private universities, with tiny biology departments and no Nobel laureates, were not the places that the ball of government funding came to rest. Last year we had gone through the usual ritual with the usual pessimism, only to find that somewhere, far upstream in the government funding process, a mighty dam had broken. Our research was on replacement processes in the replication of DNA, a long way from the RNA retrovirus that causes AIDS. But our principal keywords, Blood and Phage and Transcription, had somehow hurled our proposal into the *thalweg* of AIDS mainstream research. Suddenly we had a million dollar grant, fancy new hardware, and enough soft money for a dozen graduate students.

But in spite of all that, we had made no additions to the faculty. We still had our undergraduates, and we still had to teach courses. Cell Biology was still Cell Biology, and the arrival of great funds had not conferred instant knowledge and wisdom on our students. In fact, judging from the results of my last class test, the opposite case could be made.

I checked my appearance in a mirror hanging from the bookcase in front of my desk. Undergraduates are all right, but there is no point in giving them ammunition. Then I picked up my notes (The eighth time that they had been used for the course—time to stop updating with hand scribbles and generate a new typed set) and walked to the far end of the lab. If I initiated an experimental run now it should be completed by the time that my class was over.

As I did so I glanced at the computer summary. Apparently yesterday had been another wasted day. All the runs had produced negative results. If our ''universal DNA converter'' could ex-

ist, we seemed as far as ever from creating it.

Our lab was halfway up the hill, and the Glenney Lecture Hall was at the bottom next to the big lake. I walked across the grass, avoiding groups of students sunbathing, walking dogs, and playing Frisbee. Even at the best of times, I often felt that no more than 10 percent of our student body was trying to learn anything. Now, with bright sunshine and the term almost over, the end-of-year feeling was everywhere.

The sun was in my eyes and I had to descend a steep flight of stairs, so I did not recognize Susan Carter waiting for me at the bottom until I was only a step or two away from her.

"Doctor Benilaide?" She was a raven-haired girl with a clear complexion and a curvaceous figure, and when I saw her surrounded by would-be boyfriends I was sometimes inclined to excuse her indifferent grades. She had somehow became a senior, but she obviously lived in the middle of a continuous sexual thunderstorm. Horny adolescent males homed in on her, showed off in her presence, propositioned her during lectures, tried to talk her into evening dates instead of homework, and interrupted her every thought. Two of them waited for her now, standing at the side of the stone steps.

"Doctor Benilaide," she said again. "I know it's late to ask, but do you think I could change to an Incomplete?"

I shook my head. She wasn't stupid, but this was still the student who, through an entire class quiz in Cell Biology, had managed to refer to the subject as "cetology." "Sorry, Susan, I couldn't even if I wanted to. The final grades went into the computer two days ago."

She didn't argue, just nodded sadly and gave me a heart-melting look. I walked on towards the class—a class she was supposed to be attending but where I surely would not see her. When I was almost out of earshot I heard one of her attendant jocks laugh and say: "I told you. That's Professor Been-a-laid. Never even been asked, I'd say. She flunks everybody who looks halfway human."

Halfway human. That's right, pinhead, and that's you.

Two semesters ago I had flunked him.

And did his remark upset me, when I had heard it a hundred times before? Damn right it did.

My class was down to twenty-two people, from its mid-term maximum of twenty-six. Not bad, given the fine weather and the end of term. I dumped the pile of exam books on the front desk, and while the students dashed in to hunt for their own sets I went to the board and picked up a red magic marker (blackboard and chalk is better, I know, but as the years go by I am increasingly allergic to chalk dust).

I drew a vertical line down the middle of the board, and wrote a heading in each half: MITOSIS on the left, MEIOSIS on the right. Then I waited. It was pointless to begin the class until each student had noted his own score and looked at my comments on the answers.

"We'll be taking this up again next semester," I began at last. "But given the confusion in some of your answers,

I'm going to hit this one more time and let it sink in over the summer. Cell division can get complicated, but the principles fit on one blackboard. Basic rule: cells divide in two fundamentally different ways. *Mitosis* means that the DNA in the cell is duplicated exactly, to give double the amount. Each chromosome is exactly copied in the process, and then the cell goes on to divide and become two cells. *Mitosis is nonsexual.*" I wrote those words in the first column and underlined them. "When plants or animals lacking separate male and female forms reproduce, their DNA duplication *has* to be done through mitosis. Look at that *T* in the middle of the word, mi*T*osis, and remember." I wrote: *If you have TEA, you don't have sex.*

"Unfortunately, the textbooks often don't help. They refer to cells produced following mitosis, through simple cell division, as *daughter* cells. That is a bad name. They are better called neuter offspring."

While I was talking I looked around the class. Half a dozen students, including a Chinese girl and Italian twin boys in the front row, were hanging on my every word. Needless to say, they had been having no trouble at all. The focal point of classroom ignorance was near the back, where three T-shirted youths drooped over their desks in attitudes of extreme exhaustion or boredom. They stirred and nudged each other when I mentioned the word sex, but no matter what I said they would go out of the room as uninformed as when they came in. It was no consolation to realize that their parents were paying fourteen thousand a year for the privilege of having their children learn nothing.

I sighed, and went on. "Meiosis, on the other hand, only takes place in *sexual organisms*. And it's easy to see why it's necessary. When anything, from a mosquito to a hippopotamus, develops by fusion of a sperm and an egg, the DNA from both is in the offspring. So if the sperm cell and the egg cell each had the same amount of DNA as other cells of the body, the offspring would have twice too much DNA. To prevent that, there is another form of cell division called *meiosis*. Each of you is a product of meiosis. You all had a father and a mother, and half your DNA came from each of them. In meiosis, cells are produced with half as many chromosomes and half as much DNA as a normal body cell. These are called *gametes* — that's either the sperm or the ovum—and when they merge to make a fertilized cell that's a *zygote*. . . ."

We had been through this six times in class. How was it possible for students to miss the point, over and over again? Was I that bad a teacher? I stared at twenty-two faces, half a dozen following me, half a dozen yawning or doodling, the rest as perplexed as if I were addressing them in Mandarin.

Then I wondered if it was all relative. I was groping, too, and just as out of my depth. Maybe I was missing some obvious point in my research, shunning the self-evident as badly as my dimmer class members. (Last year one of my students had gone half a semester in Cell Biology before I found that he didn't know what a helix was. Others told him it was a sort of spiral, and he'd visualized the flight of a football.)

While I went through the description of meiotic cell division and homologous chromosome pairs, my mind wandered back to our failing experiments.

Oscar and I were trying to create a universal DNA converter—a "general DNA eater," unlike anything in nature. If we were successful, the organism we were working on should also handle viral genetic material, so our NIH grant was not illogical. Our starting point had been the most basic observation in molecular biology, that a DNA molecule does one thing superbly well: it *copies* itself, with a tiny error rate. It also, through the intermediary of the RNA molecule, controls the workings of the cell that contains it. Every cell uses the information in its own DNA, both to run operations and control cell division.

Viruses are nothing more than parasitic chunks of DNA or RNA, wrapped in a coat of protein. Once a virus enters a cell it makes use of the DNA and protein "production line" there to form many copies of itself, until the cell bursts open and releases a slew of new viruses.

So why don't you die when you get a viral infection like polio or the common cold? You don't because your body has its own immune system, a set of "defensive" cells that mop up viruses—eat them—and dissolve their alien DNA or RNA. The terrible thing about AIDS is that HIV—the Human Immunodeficiency Virus—infects, and destroys, the cells of the body that are supposed to protect us.

Oscar had had the first idea. Then I thought of a way to build the experimental system. When it showed promise, we wrote our proposal. Our "DNA converter" changed DNA in the body to a "template DNA form" that we provided. When a DNA molecule begins to make a copy of itself, it unravels the ends of the double helix to separate and leave exposed a purine or pyrimidine pair. New purine and pyrimidine molecules (adenine, guanine, cytosine, or thymine) attach themselves to make two new pairs and start production of a new double helix. Oscar had argued that the place to attack was at the point when the original double helix is in the process of unraveling. We also had a scheme to prevent our virus-gobbler from happily eating *every* piece of DNA in the human body—an important detail, since your own DNA is in every cell of you.

But our experiments, after a fine start, refused to follow the theory. We weren't blaming anyone, but every evening we would look at each other and secretly wish that one of us was smart enough to decide what was going wrong.

We were missing—what?

When the class ended I went to the cafeteria in the basement, bought a carton of low-fat milk, and sat in the sun on a wooden bench just outside the side entrance of the building. I knew that once I was back in the lab I would be swept up in experimental detail; what I needed now was an *idea*.

Oscar liked to describe things in mechanical terms. To him, we were making the smart little engine that *could*, the "Mean Machine" that would one day eat up any bad virus on Earth.

I preferred a more biological analogy. Our new organism had "eyes," chemical detectors sensitive to the presence

of "unwinding proteins" that were present when DNA replication began. It had "hands," enzymes that grabbed hold of the DNA as the double helix separated. There was "memory," the template that defined the final required DNA composition. There were "muscles" in the form of abundant ATP —adenosine triphosphate, that provided the energy for nucleotides to be stripped off the sugar and phosphate bases of the DNA, and for other purine and pyrimidine molecules to replace them.

And finally, there was reproduction. Our Mean Machine was self-replicating—and mortal. It would make copies to spread through every cell, but when it could no longer find DNA suitable for conversion it would die, quietly and with no effects on the host organism.

If I had to point to one place as the *soul* of our device, it would be the memory template. That was a DNA molecule, or a set of them, and the DNA to be converted had to be close in form to the template, otherwise the energy needed for conversion would be too great. For example, we could never convert plant DNA to animal DNA, or animal to viral form. They were too different, and Oscar's little engine that could, couldn't.

I squeezed the empty milk carton flat between my hands. How about this idea: we had used the most convenient source of animal DNA for our template, and made other DNA match it. Suppose the template itself had developed anomalies, and was foiling the match? We could find that out easily enough, with one of our new lab gadgets.

I was standing up from the bench when someone moved in front of me. It was Susan Carter.

"It's not about my grade, Doctor Benilaide," she said, before I could utter a word. "I know that's all fixed and done with."

"You weren't in my class this morning."

"I know. I'm sorry." She waved a piece of paper in her right hand. "I had to get this. That's why I want to talk to you. It's about next year."

"What about next year?" I started uphill, and she fell into step beside me.

"Professor Sawyer told me you were taking graduate students. I wondered how to apply." She thrust the piece of paper out in front of me. "That's why I missed your lecture today; they told me if I wanted my grade transcript I had to get it this morning."

In bright sunlight my eyes seemed almost as good as ever. Surely I could hold off on spectacles for another year or two. I stared at the smudgy computer listing as we approached the biology lab and had quite a surprise: an isolated D, but mostly C's, with three B's and one A.

"Susan, you did worse in my courses than anything else!"

"I know. But they were the most interesting."

"And you did best in chemistry."

"Yes, but I don't *like* chemistry. And Professor Sawyer told me that the more chemistry a biologist knows, the better. He says lots of biology teachers don't know a thing."

Thank you, Hank Sawyer. I owed him something, but I was not sure what.

"You think you can do better as a graduate student than as an undergraduate? It's tougher."

"I hope I can. I'd sure try."

"Come in for a moment." We had reached the door of the lab. "While you're here, you can give me some of your skin and blood."

I laughed at her astonished expression. "Just to add to our tissue bank. We grab anyone who comes by here." I walked inside. "Come on."

After a couple of timid trial stabs, she pricked her thumb with a sterilized needle and squeezed half a dozen globules of dark red blood onto the little plastic shield. While she did so I took a closer look at her grade transcript.

"When are you leaving campus for the summer?"

"The middle of next week. Liz Willis and I are driving west together, but she has five days of make-ups before she can go."

"Fine." I carefully labeled the blood sample and put it in the refrigerated rack, along with similar ones from me, Oscar, and half the faculty. "Write a survey of the role of reverse transcriptase in RNA virus reproduction, and give it to me before you leave. Fifteen pages, no more. If it's good I'll see what I can do about next year."

"I'll try to make sure it is." She couldn't keep the big grin off her face. "Thank you, Doctor Benilaide. I know I've given you some dumb answers in class, but I'll make this report the best I can do."

We were walking back to the door. When we arrived there my body language ought to have told her that the meeting was over, but at the threshold she halted and turned to face me.

"This is nothing to do with next year"—suddenly her eyes would not meet mine and her words came out in one embarrassed rush—"but I want to tell you how bad I feel about what Danny Fischer said this morning."

The young are marvellous. An older person would have at least given me the option of pretending that I hadn't *heard* Danny Fischer's words.

"It was nothing. Just someone being a jerk."

"I told him that if I never see him again that's too soon," she continued. "And he's dead wrong." Her cheeks were flaming pink. "Liz and I think you're very attractive. You could be married in a minute if you wanted to. People like you should be married."

"Thank you again." I took her gently by the arm and steered her outside. "Don't forget, I'll need that paper by the middle of next week."

I closed the door and leaned against it. I didn't know whether to laugh or cry. One thing was certain, if Susan Carter did research with me I was going to have my hands full. Your graduate students are like your children—you find you are involved in their health problems, love life, hobbies, families, and diet, their job applications and their interviews, their hopes and their dreams. But I liked that. It was the closest to having my own children that I was ever likely to get. Acute endometritis when I was twenty-six (thanks to the IUD) had left enough scar tissue that my gynecologist told me I was sterile "at the ninety-five percent probability level." As she told me, that was in some ways worse than assured sterility. There was the depression of knowing you almost certainly could not have children, coupled with the worry that you might become pregnant.

At the moment that was not a problem. The last love of my life had been almost two years ago. I went to look for Oscar, hidden away behind his racks. He and I never discussed such things as sex and children, but I judged him to be mildly heterosexual. Some day, almost without thinking about it, he would probably marry and become a kind, loving, and rather absentminded husband and father.

"Any great thoughts?" Oscar had heard me coming, and was peering at me through a gap in a reagent rack.

"The younger generation are clearly unfitted to run the world, but one day they're going to do it anyway. No good ideas. How about you?"

"Not an idea, exactly. But behold, I tell you a mystery." He stood up and stepped delicately out from behind his desk, holding a listing. "Have you looked at the total amount of chemical energy that our little critter uses during the experiments?"

"Not in detail. I know it's too little for us to have changed replication in the way we'd like, and the comparison of initial and final DNA composition confirms that. It's the same at the end as when it began."

"I know. But I just calculated how much energy we'd be using if every DNA base was being *examined* during the replication process, and there was no *substitution* going on. I get a result within a few percent of the energy the process is actually using."

"Telling us what?"

"I'm not sure. Telling us that the experimental DNA is being compared with the template, at every nucleotide site—and then no changes are being made?" He handed me the listing. "Here's the program, with my formulas for energy use built into it. Over to you, Alison. I have to go to another one of those godawful Interdepartmental Studies meetings. But I think there has to be something wrong with your experimental set-up."

Easy enough for Oscar to say, but I had checked the experiment over and over, to the point where if anything *were* wrong, I would probably be the last person on earth to see it.

I took his listing. However, instead of going back to the experiment I went to my computer terminal. Thanks to Oscar's passion for completeness, the entire data base for all our experiments was on-line, right back to the first run. He had arranged his new program to pull out the data for any single run and perform the energy calculation. But it was an easy change to add a program loop, so that Oscar's calculation would be performed for every experiment in the data bank.

While the computations were being executed I attached to my own directory in the Administration files and called up my grade assignments for the current semester. I had given Susan Carter a D. Now I changed it to the "To be assigned" category.

Unfair to the other students? Probably. I was not going to worry about that. Show me a totally impartial teacher, and I'll show you a robot.

The results of Oscar's program were buzzing out of the electrostatic printer, line by line. I went over to watch them. The computer was analyzing each experimental run in chronological order. The first page looked fine. The energy

used was consistent with the desired DNA modification.

The change appeared gradually, in the middle of the second page. A run appeared in which the ATP energy used was far too low—and it was also a failed experiment, in which the DNA "fingerprinting" showed that there had been no modification in the DNA sequence of our test material. The fingerprinting method was very precise, the same equipment and technique that was used routinely in forensic DNA work. Every individual in the world was different, and every one distinguishable, and the method's reliability was the main reason that Oscar and I had decided to employ human DNA in our initial experiments. I found it hard to believe that we could be having trouble with the initial and final DNA matching.

A couple of runs later, the same anomaly appeared again. And then, as though the problem was itself infectious, the low energy use came more and more often. In the runs of the past thirty days, almost every energy use was too low, and no DNA modification seemed to be taking place in them.

It *had* to be a problem with my experimental set-up. And yet I was sure it couldn't be.

When you have eliminated the impossible . . .

After the results had been printed I set out to examine the sequence in more detail, particularly the place where the problem first seemed to appear.

For no better reason than easy availability, I had used DNA from my own cells as the "template" for all our experiments. The DNA that we were trying to convert using our biological engine had been taken from a variety of individuals, and carefully stored in our "DNA library" in the form of tissue samples. Some people, such as Oscar, had provided samples more than once, and appeared in the DNA library several times. And it was that fact that finally offered some hint of a pattern.

Two months ago, our experiments seemed to be working. And as long as we used DNA that had been in the library at least that long, the experiments worked still. But with samples that had been acquired more recently, the chance of a failed experiment increased. In the past three weeks only four runs had shown success, and two of them employed DNA that had been in the library for more than two months. The other two—I felt my skin begin to goose-pimple—were from visiting scientists, strangers who had stopped by the lab for a brief visit and been talked into giving us a little bit of blood and skin. The other samples in our library were from people that Oscar and I saw and worked with every day.

I took a clean piece of paper and went back to my desk. By the time that Oscar reappeared, carrying a pastrami sub sandwich and a giant Pepsi, I had the relevant facts pared down to a minimum and laid out as cleanly as I could. He read them aloud as he ate, holding the edges of the page with his greasy fingers.

"One. All the experiments looked good until two months ago."

"Two. We have not changed the form of the organism in that period." He looked up. "Is that true, Alison? What about the DNA in the template?"

"Unchanged. We've used my DNA as the template in every experiment."

"OK. Three. In all failed experiments, the actual energy used is consistent with all the molecular *comparisons* being made, but with no *replacements* along the DNA molecule.

"Four. When we use samples that have been in our tissue bank for a couple of months, the experiments still work.

"Five. When we use samples that have entered the bank more recently, the experiments usually fail.

"Six. The exception to that statement occurs when the recent tissue came from *visitors* to the lab. Then the experiment works. Jesus. Are you sure of that?"

"Positive. I'll show you the output."

He shook his head, put down my sheet of paper, and picked up his Pepsi. Amazingly, he had left his sandwich half uneaten. For the next two minutes he sucked in silence on his straw. I knew enough not to interrupt. One look from Oscar was enough to break most pieces of experimental equipment, but he was a top-notch theorist.

At last he put down his cup, rubbed his hands absentmindedly on his napkin and then on his trousers, and said: "You know, I've been assuming that the experiments didn't work because there was insufficient energy available to make the DNA conversion to the template form."

"That's right. We knew we had to begin with DNA close to the final structure. Maybe we just weren't close enough."

"But that's not what's happening here. Look at the energy used—it's not that the process *starts* replacement and then quits because there's not enough energy available. It's that comparisons are made with the given form and the template, and then *no* replacements are performed. Not one."

"Because the initial and final forms are too dissimilar."

He shook his head. "The replacement process should at least *begin*. No, the only way to get the results we're seeing is for the given form and the template to be *identical*, so our little engine can't find a thing to replace. Our organism examines every nucleotide base, but if the match is already perfect it won't do more than look."

"But that makes no sense, either. I'm taking the samples right from our tissue bank. Every one comes from a different person."

"I know, it sounds crazy. But there's a simple way to test what I'm saying. You've been running the initial and final forms through the DNA fingerprint process. We can run a comparison between template DNA and tissue sample DNA—*before* you do the experiment."

It was a ridiculous suggestion. But it was the only suggestion we had.

And so we did it.

The Jeffreys's DNA fingerprint technique was developed over in England, at Leicester University. It produces thirty to forty dark bands on X-ray film, corresponding to repeating nucleotide sequences in the long DNA molecule. And while it is not totally infallible, it is close to it. The probability that two individuals will show the same banding on the developed film is less than one in ten billion (there are five billion people on the Earth). When we compared the DNA in our tissue bank with my

own DNA, I was convinced that we would see evident differences. And when we didn't, I was just as convinced there had to be something wrong with the fingerprint matching machine. All the recently acquired DNA samples — including the one taken from Susan Carter, less than two hours earlier!—matched mine perfectly, band for band. And the banding of every sample that had been in the tissue bank for three months or more was instantly recognizable as different from my banding pattern.

Finally Oscar quietly took a sample from his own skin with a scalpel, and fed that into the matching machine. Ten minutes later we had the developed film. It correlated perfectly with my DNA. But an old sample of his from three months ago, kept in the tissue bank, had a totally different band pattern.

"Oscar, this is crazy." I felt we should be laughing hysterically. "According to this, you're me! *Everybody* is me!"

But he wasn't laughing at all. He was staring at his own arm in disbelief, at the place where he had removed the skin sample. "The Mean Machine," he muttered. "The one thing we didn't test it for—didn't think we needed to test it."

"Test for what?"

"We knew it reproduced—we designed it that way, so there would be enough of it to work in every cell. But it does more than reproduce. It's *contagious*. And by the look of it, strongly contagious."

As contagious as the vision that Oscar was seeing. The organism was in me — naturally; but in my case it did nothing, since there was nothing for it to do. I already had my own DNA, and no one else's. But if it could be communicated by casual contact, it would have jumped quickly to Oscar—to the rest of the faculty—to the students. There had been a widespread complaint a few weeks ago of students running a low-grade fever, not enough to keep anyone in bed but enough for them to notice it. If the whole campus was by now infected, only visitors would have different DNA to offer our tissue bank. And when they left . . .

Now I had a clear mental picture of thousands of students at the end of term, streaming away from the campus to every part of the country. The organism would already be in California, in Texas, in Maine, in Wisconsin. With modern travel, how long before it was in Europe, Australia, or China?

I brought my racing thoughts under better control. If Oscar had been "infected," so that his DNA had been replaced with the template for my DNA—

"Oscar, it can't be what you're thinking. We have to be wrong about this. You're still you—you don't look like me, act like me, think like me."

"Of course not. Alison, we know that the template matching only takes place during cell replication. Nerve cells don't replicate—my brain is my own, and it always will be. Muscles, too, those cells don't divide. But my skin, and my blood, and my liver and spleen, they will have changed to your DNA patterns. They are *you*. There's nothing terrible about that. People do very well with blood from other people. So even if we can't change everyone's DNA back to their own form it won't be the end of the world. Of course . . ."

It was his turn to fade off into silence, while I shivered. We had been struck by the same thought at the same time.

"Oscar," I said. "We made the organism to affect replication—to work during mitosis. But it must work in meiosis, too. Every sperm and every ovum will carry only my sex chromosomes . . . X chromosomes. And all human offspring with two X chromosomes—"

"—are female."

No males. Which, in just one generation, *would* be the end of the world.

To tell, or not to tell. Ought we to go public at once? Oscar and I spent the rest of the day sequestered in our lab, doors locked, telephone calls ignored.

I felt we had no choice; we had to call Washington at once and talk to the Surgeon General's office.

Oscar disagreed, strongly. He made some good points. First, we had to do more tests to make sure we were right in our conclusions. Second, if we were right the whole campus was *already* infected, with no one feeling any the worse. Third, talk of a strongly contagious "plague" would cause widespread panic. And fourth, there was not a damned thing that anyone could do about the problem.

"Do you want people to hide away in their houses?" he said. "To stop shaking hands, refuse to meet strangers, lock us away and create new leper colonies? Look at me, Alison, do I seem sick?"

He did not. If anything he looked rather healthier than usual, a little thinner and a little less seedy. I agreed to wait, at least long enough for us to learn a bit more.

That was seven months ago. We are still waiting, but let me remove the suspense: in our first wild panic, Oscar and I had both committed a scientific blunder for which I would have flunked a freshman. Human males have a chromosome—the Y chromosome—that is completely absent in females. In its place, normal females have an X chromosome (occasionally, as in Turner's syndrome, a female will have nothing). The X and Y chromosomes are totally different, in structure and especially in size, so there was no way that my DNA's X-chromosome template could ever be close enough to a man's Y-chromosome to convert it. All the DNA comparisons in our experiments, naturally enough, had been for *autosomal* DNA—DNA in chromosomes that are not sex chromosomes.

So boys will continue to be born as well as girls, we have not deprived the human species of its future, and our globe is much the same as it was before my DNA spread across its face.

Much the same, but not quite. The body cells of skin and liver and blood and spleen—and ductless glands—that suffer DNA replacement are not usually associated with the "higher" human functions of thought and emotion. Oscar and I had wondered if we would ever know how far and fast our new organism had spread. General human behavior should not change, but we could hardly go up to Canada or down to Mexico and ask random strangers to contribute tissue samples to compare with mine.

But maybe we wrongly define the

higher human functions. How we think and feel about everything except questions of pure logic is decided maybe 5 percent in our brains, 95 percent in our *glands*. And how many events in human history have been the result of logical thought? Just try to name one.

Anyway, neither I nor Oscar drew the immediate conclusion when cigarette manufacturers reported a catastrophic drop in U.S. sales and raged against the new anti-smoking campaigns. And Oscar never reads the newspapers or watches television, so I was the one who picked up a different anomaly.

War makes it into the headlines much easier than peace. The people of Northern Ireland have been fighting over their border for too many generations to count. But four months ago, a snippet in the Overseas News section of our local paper pointed out that it was an unprecedented sixty days since the last violent incident. Maybe the Irish Protestants and Catholics disliked each other as much as ever, but for some reason they were not resorting to bloodshed.

I began to take a new interest in worldwide politics.

A month later, a strange quiet spread across the Middle East; no bombings in Beirut, no hostage-taking in Lebanon, a twenty-year trading agreement between Iraq and Iran. Farther east, the civil war in Sri Lanka ran out of steam, the Sino-Soviet border was peaceful, Indonesia held orderly elections, and the bloody Philippines riots ended. By that time, everyone could sense a new current in international relations. A year ago, the Soviet Union and the United States had been busy in all-out arms escalation. But last week our leaders cut through the diplomatic red tape and agreed to a far-reaching treaty, reducing nuclear stockpiles and slowing conventional weapons development. The whole world began to breathe easier.

And so did I. Oscar (thirty pounds lighter and exercising every day, to his own astonishment and under the iron hand of Susan Carter) tells me that I ought to be ecstatic rather than simply relieved. "You make Alexander the Great and Genghis Khan look like amateurs," he said. "Alison Benilaide is conquering the whole globe. She's irresistible and she's ubiquitous, billions of her, marching through Georgia, invading Delhi and Moscow and Beijing, leaping international borders at a single bound. They're all you, Alison. You are the original Ur-Mother. You should be *proud* of your DNA, not ashamed."

And finally, I think I am. I feel pride, and I would not argue if it were described as maternal. Our little engine that could may not be able to change most of the brain, but it seems to manage very well elsewhere, in the places that define our emotions and our innermost feelings. My DNA knows what it's doing. And like the rest of me, it is apparently a pacifist.

So Oscar and I didn't destroy the world. I rather think we saved it. For that, you don't get medals. On the other hand, you don't need them. ■

TRUE CONFESSIONS

Geoffrey A. Landis

Heck, I've got my faults. I guess if I had to name just one, it's telling lies. Big ones, little ones, real whoppers. I'm the kind of guy who tells kids that green lollypops are poisonous if you drink Coke while sucking on them; and when a cop stops me for speeding I look perfectly sincere when I explain how I have to rush to deliver last rites to a parishioner in the terminal ward. It's like I can be anything I want to be, if I can just get somebody to believe it.

You can tell people the most outrageous things. You just have to sound confident. Like, right now I tell people I've got a Ph.D. in physics, and I work for the space program. When they ask more, I say it's classified—guys are impressed when you work on top secret stuff—or that I work on solar energy, if it's a chick—chicks go for guys who do ecology-type stuff.

Pretty good for a high school drop out, right?

See, the thing is, I don't *sound* like a drop-out. That's because I read a lot. In fact, reading so much is how come I dropped out of high school. When I was a kid I always wanted to be a scientist or somthing, but when it came to high school, and I started taking math and stuff, I found that it was easier to lie back and read science fiction than do homework. I just got further and further behind until finally I couldn't catch up.

Like, I went to this big writer's school in Michigan, right? It's pretty famous, it's called the Clarion Workshop, it goes for six weeks every summer, and a lot of pretty famous writers studied there — famous if you read a lot of science fiction, anyway.

I was kinda surprised that I got in, really. It was the only thing I'd ever done that I got in without faking credentials—but when you think about it, writing stories is really no more than telling lies—or elaborating on the truth, as I prefer to think of it—and I'm real good at that.

So that was my big chance: nobody had heard the lies, and I could finally cool it for a while and just be me. So, the first guy I meet at the workshop, I ask him what he does, and he says, he's a student at MIT. Before I even think, my one-upsmanship circuit cuts in, and I say, "Oh, really? I went there undergrad. Maybe we have a few friends in common." I didn't think, it just popped out, and I'm just cursing myself. Why did I have to say that? Now how can I go back and admit I'm nobody in particular, a part-time carpenter out of work?

Turns out we actually did have a friend in common, and it even turns out this guy thinks I really *was* an MIT student.

See, when I dropped out of high school, I never did get around to telling my parents. I was going to, but they were just ever so proud of how well I was doing (I guess I was beginning to hedge the truth a bit even back then). I couldn't exactly think of how to phrase it, and it never quite seemed the right time to bring it up. Then it got to where if I told them, I'd have to admit that I'd been lying to them for a month, and then almost a year. Jeez, it would have just broken their hearts. It was just common decency on my part that made me keep it from them, really.

So, when they asked me where I

wanted to go to college, I blurted out the first name that came to mind, and said I wanted to go to MIT. And they looked at each other, kinda worried but kinda proud, and said, well, that's pretty expensive, son, but I guess we can tighten up the old belts, if you can get in. And they said that MIT was real hard to get into, even straight-A students like me sometimes didn't get accepted, and that they'd still be proud of me even if I couldn't make it and had to make do with Michigan State or something. So I sent away for the admissions stuff, and pretended to apply, and then when everybody else started to get their college acceptances, I just forged a letter to myself that said I'd been accepted.

When I visited Cambridge "to look over the campus" I opened up a bank account and a post office box, so I could take the tuition checks from the post office box right into the account. I felt kinda guilty, but what could I do? I could see they couldn't really afford it—my mom started working a second job as a bank clerk, she said because she wanted to be liberated, but I knew better. And they just seemed so proud of me when I came home on summer vacations.

I used to hang around MIT a lot, eat meals at their cafeteria, hang out in the dorms, the science fiction society, all that. I learned to talk MITese. It was a great scam. See, the Boston area is full of colleges, lots of coeds, and they all know that MIT guys are going to go and make piles of cash as soon as they graduate, right? But most MIT guys are, well, rather socially inept, if you get what I mean. If they had any idea how to impress girls, they could've been breaking hearts right and left. So, I let everyone think I'm a MIT student, but I'm cool, I hang out at the beach and all the cool places, I've got a nice car and plenty of money (thanks to the tuition checks). I picked up chicks in droves.

So when my folks came up to Cambridge to visit, I showed them around MIT (the "toot," in MIT parlance—short for the institute) just like I went there. They were so easy to fool I almost cried, it was so pathetic.

The only tough part came when I was supposed to "graduate." My folks absolutely insisted that they would be there to see me walk down the aisle and pick up my degree, no matter how much I said I didn't want to go. "It's going to be the happiest day of my life, and I wouldn't miss it for anything in the world" is how my mother phrased it. I could crash a lot of MIT functions, but faking graduation would be tough. I finally had to tell my folks that I was short a few credits for my "double major" (Electrical Engineering and Physics—I wanted to make my folks *really* proud of me) and had to go to summer school. That way I didn't officially graduate until the next summer, when I made damn sure I had a "job" that wouldn't give me any time to go to graduation.

Of course, that wasn't the only kind of lies that I told. To get women to go to a motel with me (never home—that would give too much away), I'd casually mention how I made my first million in the stock market when I was eighteen. Or I was the location scout for a Hollywood producer; I was Senator Chafee's illegitimate son; I was the special assistant to the secretary of state.

During the presidential campaign I used to be the state campaign coordinator for Gary Hart. For variety, I might talk about my time in 'Nam. I had a scar on my leg (from a bicycle spill when I was eleven) that I could show off, along with some pretty hair-raising stories I got from a paperback—true stories, believe it! Just elaborated a little. Or I'd talk about being a mercenary in El Salvador. They all worked pretty well; you just had to tailor the truth to the person you were selling it to.

Well, I told my folks that I was working for a hi-tech research company and continued to bum around and do odd jobs, living mostly on the "tuition" money I'd gotten from my parents. I moved to Rhode Island when I heard about a shortage of carpenters there, applied for a few jobs with fake credentials. Got fired after a day—"You don't know squat about carpentry, boy"—but I learned enough on that job that when I applied for the next I could brazen it out for a week, and after that I'd learned enough to find jobs where you could just stand around looking busy and let somebody else do the hard stuff. Unlike the jobs I was qualified for in fast-food joints and department stores, it was pretty unlikely for one of my friends to see me on the job and wonder how come somebody who made a million in real estate is working minimum wage? ("To see what the working-class is like," I said—and quit *that* job pronto.)

I started hanging around Brown University; they had a great bar where the graduate students went. Something about an Ivy League school—anyway, it was a switch from MIT. I got a kick out of being taken for a grad student. I let the physicists think I was in engineering, the engineers that I was in chemistry, and the chemists that I was in physics. I kept to the hard sciences; that way I could be condescending and supercilious to mere humanities students. After a while I found an engineering professor who was going to Poland for a two-year sabbatical, so nobody could contradict me when I said he was my thesis advisor.

It was about that time that I went to this Clarion writing workshop. They require a story submission for an application, and I was pretty damn surprised when I got in. I mean, I'd been reading science fiction by the truckload ever since I was ten, but I'd never thought I could actually *write* it. I really was planning to just be myself, but after I started out elaborating the truth, there was little else to do but go on with the whole schtick about being a graduate student in physics, and the whole works. They bought it wholesale

I even sold a few SF stories to the pulp magazines, although I figured out real fast that there was no money in it, unless you're the type who gets off on sitting by yourself in a room with just a typewriter for company. A new dodge I started using was telling girls that I was part of the team that wrote sci-fi under the pen name "Isaac Asimov." That really worked well at science fiction conventions—you get them alone, pretend to be slightly drunk, and then just act horrified that you let slip this secret. You make them promise they'll never reveal the secret, then you seal the promise with a . . . well, you get the idea.

Eventually the professor who'd been in Poland came back, and I figured it was time to leave Rhode Island pronto. I let everybody think I'd defended my thesis and told them they should call me Doctor Landis now. I even made up a "thesis"—random chapters photocopied out of dissertations from the library. I picked ones with a lot of equations, to be sure that nobody but a real expert could say for sure I was sputtering gobbledygook, and then I made sure never to show it to anybody with more than a bachelor's degree in liberal arts.

I picked Cleveland mostly because nobody knew me there. I was starting to have trouble keeping track of which versions of the truth I'd told to whom. I barely scraped by once when somebody who thought I was a millionaire stockbroker wondered how come all of a sudden I was a pennyless grad student—fortunately the market crash of '87 gave me a good story, which I dragged out for over an hour just for the pleasure of embellishment.

As it turns out, NASA has a big lab in Cleveland. My parents were just *so* proud when I told them I have a new job with the space program, doing secret stuff that I couldn't tell them about. I kinda hinted that I'd been selected as an astronaut for a supersecret star-wars mission, a story which I embellished a bit and used on the girls as well. That was about the best dodge yet—everybody knows about astronauts' legendary "right stuff" in the sack. I got pretty bold; sometimes I said I'd gone to the Moon and everything. It's amazing, really, how few people have any idea which astronauts went to the Moon, except for John Glenn, of course. Well, that one was a lot of fun. It worked great until I tried it on a chick who was a space nut and knew the names of all the astronauts, even the ones who never flew. I told her my mission was one of the secret military Moon probes, but she seemed rather skeptical. I palmed her off with some hair-raising stories about secret fighter missions in Nicaragua, and then said I had a plane to catch. After that I decided to save the astronaut story for the ones who looked like the other dodges wouldn't pan.

So, I'm having a great time in Cleveland, spending evenings in the bars around NASA, and one day I strike up a conversation with this guy in a business suit. I go through the usual bullshit (noticing a few girls on the side, who can't help but "accidentally" overhear the conversation), how I worked on this project, and that one, and designed these great things. I've been hanging around NASA long enough to have the lingo down pat, and talk convincingly about TAV, and STS, and the SP-100 initiative, and what we have to do to upgrade the Space Station IOC into NARAM capability . . .

. . . and it turns out that this guy is a *science fiction fan!* And he's really impressed, not by my Ph.D (I said I'd worked with that famous theoretical physicist who died last year) or by all the important projects I'd worked on, but by the fact that I attended Clarion, and by those three stories I'd had in the pulps. And he says that he's out here looking for somebody to fill the job of vice-president in charge of research at—"well, let's just say a major defense contractor, OK?" And they want some-

body who has a solid technical background, but imagination as well. And right then and there he invites me to come to Washington next week for an interview—"and bring a copy of your resume."

Well, what the hell, I figure it's a free trip, a chance to see my hard-earned tax dollars at work, and that by the time they get around to checking my references, what can they do? So the next week, it's first class to Washington.

I got met at the airport by a couple of guys in seersucker, and they lead me to a helicopter. Pretty classy, I think. I've never been to Washington, so I don't really pay attention to where they're taking me, I'm too busy checking out the view as the chopper makes a low-pass over the Washington Monument. So it's still a surprise to me when they take me inside, pat me down for weapons, and lead me into the room for the interview.

Yeah. Not some company bigwig. It's the president, old Ronny himself. Well, he gets up, we get introduced, we shake hands, the secret service men move back a discreet distance to give us some privacy . . . and I discover I can't think of anything to say. Nothing. So after an awkward moment or two, I just blurt out, "Gee, Mr. President, I've seen all of your movies, and I really admire them."

And his eyes just light up, and he ways, "Why, thank you, thank you. Tell me, which ones did you particularly like?"

And now I'm really stuck, because to tell the truth, I only know the title of one of them, and that's one that I think he might want forgotten. But it's the only one I know, so: "Well, I've always thought that *Bedtime for Bonzo* was a vastly underrated film."

And he leans back, a serious look in his eyes, and says "You know, you're darn right about that. That was a fine movie, one of the best I made, and the darned critics just tore it to ribbons."

—and he goes on, and I ask him about some of the stars he knew in Hollywood, and he gets in to telling stories about some of them (pretty bawdy stories, too—and you'd be surprised at some of the names. But *funny*—the man can tell a story like to make you just fall over laughing). We're having a great time for about an hour, before one of the secret service men or secretaries or something along those lines comes in and *hrrumph*'s a couple of times. The president looks up, sighs, and signs something or other and gives it to the man and then, reluctantly, gets up to leave, not without first telling me what a fine young man I am, the type of person the country really needs more of. And we hadn't spoken one word about defense, or aerospace, or jobs, or anything.

Anyway, when my friend from the bar comes out to get me, he smiles and slaps me on the back and says, "Well, Dr. Landis, looks like you're in like Flynn. I knew you could do it."

I smile back, and say, "looks like it," and then, to heck with it, might as well ask: "But I'm still not quite sure just *what* I'm in."

He looks puzzled, and says "You mean Ron didn't explain it to you?" I shake my head. "Not even the basics?" I shake my head again, and he shakes his as well, and says that it just beats

the heck out of him how I can talk with the president about national defense for an hour and never even ask for details of the job.

I decide not to enlighten him as to exactly what we talked about, and he explains the job. Turns out that the president is worried that his pet defense projects (which my friend calls by a set of initials, SDI) is going to be gutted by the next administration. So he's decided to set up this super secret research establishment to work on it, funding it by some top secret way of syphoning money from the social security fund without anybody ever having to account for it (and the way he talks, I get an impression like this sort of thing has been done before. Suddenly I have a much clearer understanding of the budget deficit). They need a director for the project, and all this subterfuge about a "research vice-president" was just a smokescreen.

About this time I figure out two things—first, that those two interviews, the one in the bar and the one where we talked about movies, were all the interviews that there were going to be, and the job was mine if I wanted it. And, second, that *nobody was ever going to check up on my credentials!* This job was so supersecret that not even the CIA was going to know about it!

My head is kinda beginning to spin, but at least I remember to ask about salary. And the guy kinda smiles, and says, well, the research budget to start out is going to be five hundred a year.

I guess I look rather disappointed, and I say "just five hundred?"

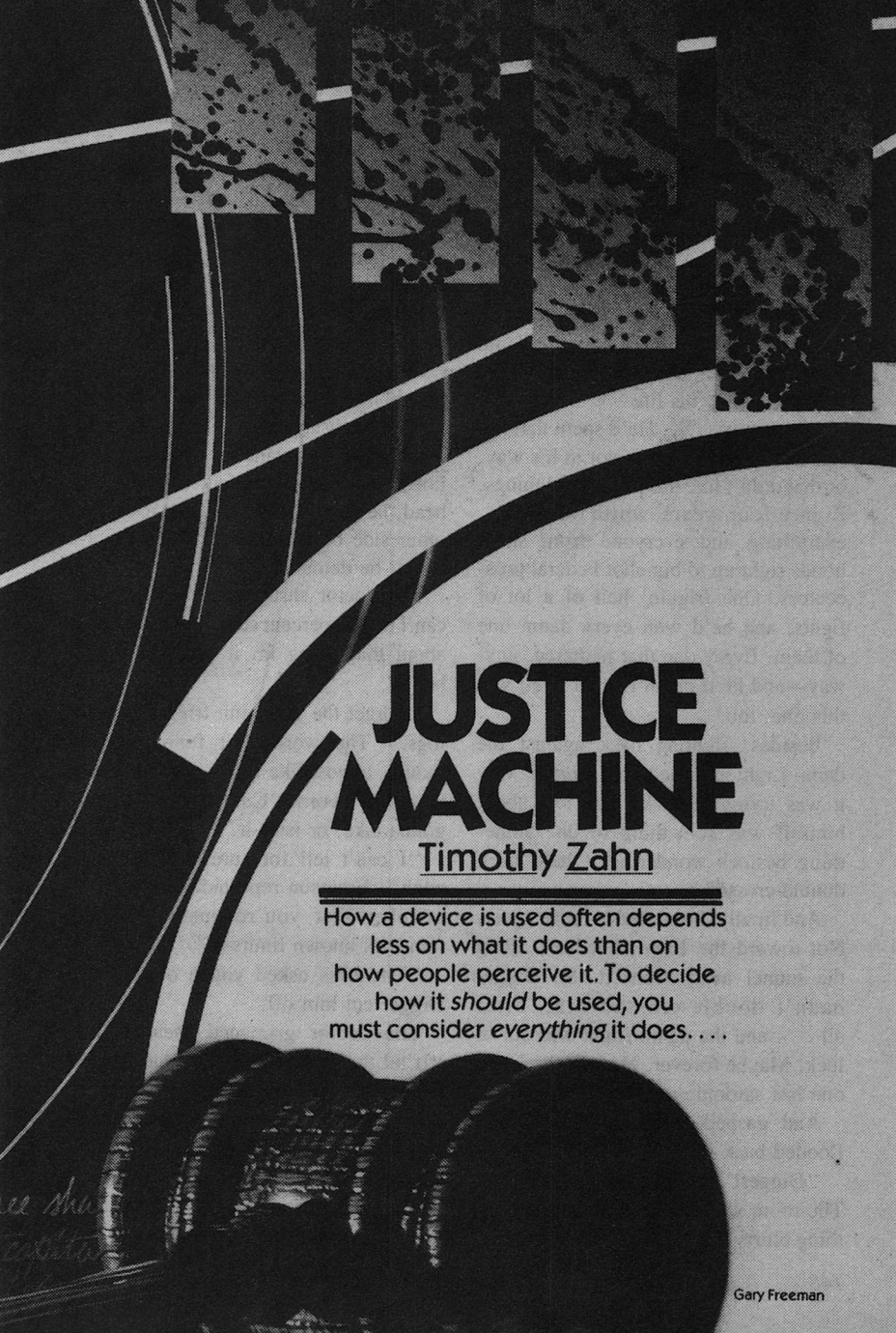
He looks real serious and says, "well, I know five hundred million isn't a whole lot for a project like this, but it should be enough to get started, and we expect to be able to push that up a bit once we get the funding geared up. And, of course, five hundred stretches a lot further when you don't have those damn government bean-counters looking over your shoulder to tie everything up in paperwork." And, with a wink he says, "Naturally, it'll be up to you to decide just how much of that is to go to administrative salaries."

So, that's how I got to be here in Washington. I've been having a ball spending the money, but even as fast as I can spend it, it's still piling in faster than I even want to think about. I have about a thousand bank accounts in a few hundred names, and I've hired a guy to do nothing but open up new accounts and put money in them. For fun, I mail out thousand-dollar bills to people randomly chosen out of the phone book. I'm sure that sooner or later somebody is going to figure things out and put a stop to it, right? I mean, someday they'll wonder where all that money is going to. It just stands to reason, doesn't it?

Doesn't it? ■

●We thought, because we had power, we had wisdom.

Stephen Vincent Benét



JUSTICE MACHINE

Timothy Zahn

How a device is used often depends less on what it does than on how people perceive it. To decide how it *should* be used, you must consider *everything* it does. . . .

Gary Freeman

For a long time—longer than he thought he had any business being there—he floated in the middle of the long tunnel. Around him all was gray. Behind him, the gray turned to black; ahead of him, far down the tunnel, was the Light.

He tried not to look at the Light. It bothered him, the way the Light seemed to see right through him, right down to the middle of his mind. It bothered him a hell of a lot worse the way the damn thing made him start thinking about the way he'd lived his life.

But that was OK. He'd spent that life fighting everything that got in his way, or that didn't like the way he did things. Eighty-four years worth of fights, everything and everyone from street hoods right up to big-shot Federal prosecutors. One friggin' hell of a lot of fights, and he'd won every damn one of them. Every one that mattered, anyway—and he'd damn friggin' well win this one, too.

Besides, fighting back against the damn Light and the damn friggin' way it was trying to make him feel about himself was something to do. Something besides wondering if he'd been double-crossed.

And finally, he started to move again. Not toward the Light, but back along the tunnel away from it. So Digger hadn't double-crossed him, after all . . . and the damn Light was out of luck. Maybe forever. He sent the Light one last sardonic smile—

And gasped as sensation suddenly flooded back in on him.

"Digger!" he managed to get out. The room was spinning around, everything blurry. He squeezed his eyes shut, shivering as his whole body felt like it was burning up with a cold fire—

"Right here, Mr. Cavanaugh," the familiar voice came. Familiar, but like his eyesight, there was something friggin' strange about it. "Hang on—the doc's gonna give you something."

He felt the stab of a needle somewhere on his arm. Clenching his teeth together, he waited . . . and a minute later the room seemed to settle down. Carefully, he opened his eyes again. Still blurry, but the double images were starting to disappear. He could see now that Digger was standing over him, the lined face pretty worried. Turning his head, he searched out the doctor on the other side of the table. "Well, Emerson?" he demanded.

The doctor shrugged. "Naturally, I can't be 100 percent sure—I warned you about that going in, if you'll remember—"

"Forget the goddamn friggin' warnings." The words felt funny in his mouth, almost like it was the first time he'd ever sworn. "Cut the crap—is this gonna take, or isn't it?"

"I can't tell for sure, Mr. Cavanaugh," Emerson repeated. "Try to remember that you're pushing Soulminder's known limits—"

"The boss asked you a question," Digger cut him off.

The doctor grimaced theatrically. "If all the side effects are gone within twelve hours," he sighed, "and they stay away for at least a week, I'd say it worked. Of course—" he nodded his head back behind him— "even if something goes wrong, you're not in any danger. Your Mullner trace is still on

file, and I've set the readouts to alert me if you come back in."

Back into Soulminder . . . where the Light would be waiting. "Yeah, thanks, but I think I'll pass." With an effort, he swung his legs over the edge of the table, feeling Digger grab his arm as he did so. His whole body still felt funny, but not as bad as it'd been. He pulled himself up into a sitting position . . . and found himself staring at his hand.

His hand. A real, flesh-and-blood hand. After being a loose spirit rattling around Soulminder, he couldn't believe how good it was to be alive again.

Alive for now. Maybe alive forever.

The steady drizzle that had wound up ruining most of the weekend had finally gotten a grip on itself and become a full-fledged rainstorm, hammering at the triple-glazed, security-wired windows with drops that sounded for all the world like small hailstones. Glowering out at the soaked Washington scenery and the uniformly gray sky beyond it, Dr. Adrian Sommer tried to remember the last time he'd seen the Sun. "I hate living in Washington," he growled.

"You don't live in Washington," Jessica Sands corrected absently from her desk across the room. "You work in Washington. You live out in Chevy Chase. There's a big difference."

"To whom?" he retorted.

"To everyone else in Chevy Chase, I presume," she shrugged. "You finished looking over the New Orleans progress report?"

"As finished as I intend to be," Sommer told her. "Looks like the office will be ready to go just about the time the annual August steambath rolls in. Naturally, you're going to want me to go down there for the christening?"

She looked up at him, a patient look on her face. "Are we going to have to go through this every time a new Soulminder office opens up? As long as you're the one the TV cameras are crazy to focus on, we haven't got any choice in the matter. Steady profits or not, Soulminder is still dependent on favorable publicity—and I, for one, would hate to have come this far and then lose everything we've built."

Or everything you've *built*, he corrected her silently. Co-creator of the Soulminder miracle and—on paper, anyway—the director of the entire corporation, Sommer had long since noticed that more and more of his time these days was being taken up by public relations froth instead of with real policy work.

Small wonder, really. It was Sands, not he, who had the shining-bright vision of what it was she wanted from Soulminder; Sands, not he, who had proven to have the skill and the drive to bend the corporation in the direction she wanted it to go.

Sands, not he, who desperately wanted to live forever.

"You make it sound like the opening of a new Soulminder facility is front-page news these days," he grumbled.

"It is to the city involved." She peered across the room at him. "What are you so surly about today, anyway? Just because Barnswell wants to use us for target practice again?"

He snorted. "What's this *us*, paleface? *I'm* the one who has to sit at these stupid hearings and act polite."

Her face softened a little. "I know,

Adrian, and I'm sorry. Just remember that every time he acts like the bigoted idiot he is, he alienates his colleagues just that much more. And with every single one of them on file here. . . ." She shrugged.

"They're starting to take attacks on Soulminder personally," Sommer sighed. "Yes, I know. I'm not sure I like *that* trend, either. Unanimous praise for *anything* makes me nervous."

"I'm sure Barnswell's crowd will do their best to keep the praises from being sung *too* loudly," she said dryly.

"I'm sure they will," he echoed.

For a moment the room was silent, as Sands went back to whatever she was working on and Sommer skimmed through the comprehensive schedule for the day's work. He was only about halfway through when the phone rang.

"Dr. Sommer, the Capitol just called," his secretary reported. "The limo will be here in about fifteen minutes."

"Thank you," Sommer said. An item on the schedule caught his eye; punching keys one-handed, he called up the full file. The list of names. . . .

The secretary was still on the phone. "I'll be waiting at the security entrance," he told her. Hanging up, he got to his feet and scooped up his briefcase. "If you need me I'll be down in the parameter test lab," he told Sands as he headed for the door.

"Now?" she called after him. "Adrian—"

"Don't worry, I won't keep the senators waiting," he called over his shoulder.

Even after a solid four years in operation, there was still a great deal no one knew about Soulminder.

Its ultimate range, for one thing—how far a dying person could stray from the computer/trap arrangement that held his Mullner soul-trace on file. Or what was rather vaguely called the timeline question: how often a person needed to update his Mullner trace to ensure that the trap could successfully recognize and lock onto his soul.

There were theoretical models that could hint at the answers. Unfortunately, the only way to know for sure was to experiment. . . . and since by necessity such experiments would eventually lead to death, it followed that those being experimented on needed to be expendable.

The pool was, unfortunately, a large one.

Six of them were waiting quietly in a row of chairs along the wall just inside the lab complex, their handcuffs glinting in the bright lights. The one on the end— "Hello, Willie."

"Well, hi, Dr. Sommer," the thin young man said, a touch of surprise in his face and voice. "How you doin'?"

"I'm fine," Sommer told him. "What are you doing here?"

Willie blinked. "I'm helpin' out, 'course. Like always."

"Yes, but—" Sommer broke off as a familiar face came around a corner. "Tom, come over here a minute, will you?"

"Dr. Sommer," Dr. Thomas Dumata nodded, looking as surprised to see Sommer as Willie had. "I thought I saw you listed for a stint on Capitol Hill today."

"What's this man doing here?" Sommer demanded, pointing at Willie.

Dumata glanced at Willie. "He's part of a mid-range timeline experiment," he said guardedly.

"And how many times has he been run through Soulminder?"

"Ah . . . I'd have to look that up—"

"I'll save you the trouble: the answer is five. He's died and been transferred back five times. So I'll ask you again: what's he doing here?"

"Dr. Sommer—?"

"Quiet, Willie. Well?"

"Dr. Sands gave the timeline studies an exemption from the standard policy," Dumata said reluctantly. "It seemed to make more sense to keep going with the same individuals than to start new batches all the time and have to fiddle with the intervals we're using."

With an effort, Sommer held onto his temper. "And are you aware that the ACLU is running a major court challenge against these tests at the moment?"

"They're all volunteers—"

"Who signed up for five tests each. *Five*—not ten or twenty or thirty."

"I understand, Dr. Sommer. But—"

"But nothing. Come on, Tom, we barely got this one through by the skin of our teeth as it was—all we need is for people to find out you've got prisoners signing blank checks."

"Prisoners have the legal right to volunteer for risky scientific experiments," Dumata said doggedly. "If they insist on doing so more than five times, the ACLU can complain to *them* about it." He gestured toward the line of prisoners. "Go ahead—ask him if we twisted his arm."

Frowning, Sommer turned back to the line of prisoners. "Willie?"

"I 'preciate what you're tryin' to say, Dr. Sommer," Willie said. "But, really, I want t' do this. I gotta—" he shrugged—"lotta stuff to make up for 'fore I die."

Sommer stared at him. He'd seen Willie when he first came to Soulminder. Remembered what he'd been like. . . . "What sort of stuff is that, Willie?" he asked.

Willie grinned, self-consciously. "Come on, Dr. Sommer—you know what I did. Shot down those four people for nothin'." The smile disappeared. "I wish I could do somethin' for them. Somethin' to make up for it. But I can't. So—" he gestured with his manacled hands—"I come here."

Sommer looked at Dumata, back at Willie. "You've certainly changed, Willie," was all he could think of to say.

The dark eyes looked back at him steadily. "You don't look at that Light in there without it makin' some changes in the way you see things."

A gentle chill ran up Sommer's back. He remembered the Light, too. "No," he agreed soberly. "You don't."

"Dr. Sommer?" the lab's receptionist called. "Security says your limo is here."

Sommer took a deep breath. "All right. I'll want to talk to you later on, Tom. Good-bye, Willie. And . . . thanks."

Turning, he hurried out of the lab wing and down the hall toward the security entrance. As Sands had warned,

the senators wouldn't be pleased if he were late, and with the rain outside the trip was likely to take longer than usual.

He rather hoped it would. He had a lot to think about.

The hearing went about the way Sommer had expected it to: powderpuff questions from most of the committee, hardball ones from Senator Barnswell. No big surprises, no real substance, and most of it territory that they'd already gone over before.

Until the very end.

"Now, there's just one more thing, Dr. Sommer," Barnswell said, his almost lazy tone contrasting sharply with the glint in his eyes. "You've stated several times before in front of this committee that your people have got safeguards all over your fancy Soulminder equipment—in fact, I believe you once said that there was no way at all that anyone could abuse or manipulate Soulminder for illegal purposes. You remember saying all that?"

A quiet alarm bell went off in the back of Sommer's mind. "Of course, no security system's completely airtight, Senator," he said cautiously. "On the other hand, I think we can claim to have arguably the best arrangement anywhere in the country."

"Uh-huh," Barnswell grunted, his voice abruptly turning icy. "Then maybe you'll tell me, Dr. Sommer, how it is that less than twelve hours ago a man wanted by the FBI—wanted very badly, I might add—managed to die, get locked up in your Soulminder traps, *and* get put back into his body without your fancy security system blowing the whistle on him.

"You want to tell me how that could happen, Dr. Sommer?"

He reached the office, still seething, to find that Sands had a visitor.

"Adrian—good, you're back," she said, relief evident in her voice. "This is Special Agent Peter Royce from the FBI."

Sommer nodded briefly to Royce. "I don't suppose there are any prizes for guessing why you're here."

"Not really." Royce looked at least as annoyed as Sommer felt. "I gather you've heard all about Cavanaugh's little sleight-of-hand trick last night?"

"I had the high points thrown in my face, yes," Sommer corrected him sourly. "None of the details—Barnswell doesn't believe in giving out free information unless it's likely to draw some blood."

Royce nodded. "Yes, I'm familiar with the senator. You know anything about Mario Cavanaugh?"

"Barnswell said he was the head of one of the East Coast's biggest independent mobs. Nothing more."

"Semi-retired head," Royce corrected him. "Eighty-four years old, in poor health . . . and, at the moment, in deep hiding."

"From you or his own people?"

"Possibly both. We've finally gotten something solid we can nail him to the wall with, but given the choice we'd rather peel the skin off his organization. He knows it, they know it; hence, the vanishing act."

"So how does Soulminder figure in?"

"Cavanaugh was one of the first people to sign up when we got the office

going," Sands interjected. "When the indictments came through our flags picked up on his name, and the FBI directed us to set up a red light in the event the file was ever accessed."

"So why didn't it trigger?"

"For the simple reason," Royce said heavily, "that Cavanaugh didn't get reborn here. He did it out in Seattle."

Sommer stared at him. "In *Seattle?*" He looked at Sands. "He had *two* traces on file?"

"You got it," Sands sighed. "And somehow no one spotted the one out there."

Sommer shook his head, a shiver running up his back. "That was one hell of a risk for him to take," he murmured.

"What, that we wouldn't spot the duplicate?" Royce frowned.

"That having two functioning traps trying to grab him at the same time wouldn't do something terrible to his soul."

Royce's lip twitched. "I never thought of that," he admitted. "I assumed that the one nearest him would automatically do the grabbing."

"Obviously, it did," Sommer said. "But we've never done that experiment ourselves with either of the last two generations of trap design. He could have wound up with his soul ripped in two."

Royce hissed between his teeth. "That sounds like Cavanaugh. He was always the type to take big gambles."

With an effort, Sommer shook the image of a bisected soul from his mind. "So what can we do?"

Royce nodded at the computer terminal behind Sands. "It occurred to us that if Cavanaugh managed to get himself on file in *two* places, there's no particular reason he can't be on file in every one of your offices. Might be locking the door after the car's been stolen; but then, it might not."

Sommer looked at Sands. "I hope you're doing more than just checking names."

"Don't worry, we're doing it right this time," she said grimly. "We're comparing Cavanaugh's Mullner trace with every single one we've got on file."

Sommer felt his eyes goggle. "You and whose Cray-4?"

"The NSC's," she said, sounding distinctly unhappy about it. "They generously leant us some of their spare capacity."

Sommer swallowed. "I see." The thought of a hundred thousand confidential soul-traces being sifted through a government computer. . . .

On the other hand, Sands was far more paranoid about the possibility of government encroachment than he was. The fact that she was going along with this meant either that she'd decided there simply wasn't enough worthwhile data to be gleaned from the traces—which was certainly true—or else that she'd already argued the point with Royce and lost. Either way, probably a good topic to steer clear of. "We have anyone talking with the Seattle office directly?" he asked Sands instead.

She nodded. "Compton's been burning up the line to them for the past half-hour. He's ready to go out there in person if it seems useful."

"Good. Well, then—"

The phone beside Sands trilled. Snorting under her breath, she snatched

up the handset. "This better be important," she warned.

And as Sommer watched, the lines around her eyes tightened. "Damn," she breathed.

"What?" Royce demanded.

She shook her head briefly, stabbing for speakerphone. "How long since the trap was triggered?" she asked.

"Almost twelve hours," the monitor's voice came from the speaker. Sommer could hear a slight tremor beneath the words. "His name's Jonathan Pauley, twenty-six years old, from Bethesda. I've just finished checking with all the area hospitals and morgues — nothing."

"What is it?" Royce murmured.

"One of our clients has triggered a trap," Sommer told him grimly, "except we don't know where his body is."

Royce swore gently under his breath. "And it happened twelve *hours* ago?"

"It's not necessarily that bad," Sands told him. "A lot of hospitals keep terminal patients on life-support and neuropreservatives even if they're not wearing Soulminder bracelets. Just in case. Have you alerted Security, Hammond?"

"Yes, Doctor. They've got some people doing a backtrack on him."

"All right. Keep us informed."

Sands keyed off the phone, and Sommer could see her brace herself as she looked up at Royce again. "There's a good chance they'll find him," she said. "This has happened before."

"Ever lost one?" Royce asked bluntly.

Sands didn't flinch. "Not yet. I'm sure we will, eventually."

"Well, you'd better hope it's not today," he said. "All you need is something like that on top of the Cavanaugh fiasco."

Sands drew herself up in her chair. "Pardon me, Mr. Nolan, but I hardly think we can claim full credit for the Cavanaugh mess. We set up our computer red light precisely the way your people told us to."

Royce shrugged. "The media may not notice the distinction."

"You're going to release it?" Sommer asked him. "I mean, wouldn't it be to your advantage to let Cavanaugh think we still hadn't noticed?

"Probably," Royce grunted. "But that decision's pretty well out of both of our courts. Even granted that Barnswell has excellent information sources, if *he* knows, the newspokers can't be far behind. Still—" he added, levering himself out of his chair— "the media *does* have a history of being gentle on you people. You've got my number, Dr. Sands—keep me informed."

He left, and for a moment Sommer and Sands just looked at each other. "They won't be nearly so gentle," Sommer said at last, "if it turns out we've lost a client."

"No," Sands agreed soberly. "They won't."

There was nothing about it on the midday news; not even a hint in the afternoon papers; and by the time six o'clock rolled around Cavanaugh was starting to get more than a little edgy. Brilliant and gutsy though his plan might have been, it was pushing things way too far to think it had been *so* surreptitious as to sail totally past Soulminder's notice. Unfortunately, the only other options were that either he'd be-

come so important that the government had slapped a secrecy lid on the whole thing, or else he'd become so *un*important that they didn't even care anymore what he did. Neither alternative was especially pleasing to him.

But then came the evening news—and life was back on a reasonable footing again.

It was a short report, hardly more than a minute long, but in that brief time they managed to hit the high points. The notorious criminal Mario Cavanaugh had managed to escape death, thanks to Soulminder, and then disappear before anyone thought to notify the authorities. The FBI wouldn't speculate as to his whereabouts, but there were suggestions that an old man who had gone through Soulminder once was highly likely to do so again, and the next time they would be waiting.

The news turned to the start of the baseball season, and Cavanaugh clicked off the set with a grunt of satisfaction. He'd pulled it off, and the Feds were both furious and helpless. All in all, better than he'd dared to hope.

And yet. . . .

Sipping at his beer, Cavanaugh frowned unseeingly at the blank TV screen. For just a minute, there, the satisfaction had been tinged with something else. Something he hadn't felt in over fifty years.

Something that had felt disturbingly like guilt.

It was nearly ten o'clock, and Sommer had just decided to give up for the night, when the long-awaited knock came on the door. "Come in," he called, pushing the lock release.

It was Frank Compton, Soulminder's chief of security. "Dr. Sommer," he nodded in greeting, walking into the office with his usual easy grace. "The telltale board said you were still here, and I thought you might want to hear this."

"You've got some news about Jonathan Pauley?" Sommer asked hopefully.

Compton's lip twisted. "News, yes. Good news, no. We still haven't had any luck locating his body, and I'd say chances are good we never will."

"Why not?"

"Well, there're still some leads we have to run down, but at the moment it looks like Pauley disappeared nearly three days before he showed up in Soulminder."

Sommer felt his stomach tighten. "What do you mean, disappeared? Disappeared how?"

Compton shrugged. "All we know is that he didn't come into his office on Friday and that they tried all day to get hold of him. His mail for Friday, Saturday, and Monday hadn't been picked up, and his neighbors haven't seen him since Thursday night. Could be he decided to go on a quick vacation and got in trouble."

"Or maybe he was kidnapped?" Sommer asked.

Again, Compton shrugged. "There's been no ransom note. Besides, he wasn't exactly the classic kidnap profile." He pulled out a well-worn notebook, found the right page. "He'd been a realtor for the past five years—good one, too; got his picture in the paper about a month ago for racking up the highest sales numbers of anyone in the D.C. area.

Not exactly rolling in money, though. He was a good solid Catholic—went to Mass at least twice a week, his priest told us, and was involved with a lot of their other activities."

"Not exactly the type to be involved in shady activities," Sommer commented.

"Not even close," Compton agreed. "Let's see . . . he was unmarried, parents living comfortably but without extra cash on hand; ditto for one brother and two sisters. And that's about it for now." He offered Sommer the notebook.

"I wish you wouldn't keep talking about him in the past tense," Sommer growled, glancing over the notes. In his mind's eye he saw Pauley's battered body lying off in a ravine somewhere . . . "We have *got* to get that satellite system going," he muttered. "Running the heartbeat screamer through cellular phone systems loses us far too much territory."

"Oh, that's the other thing," Compton said with a grimace. "His officemates said he usually didn't bother to wear his bracelet. Thought it looked too elite and upper-class-snobby. The only reason he was on Soulminder at all was that his company bought slots for all their top salespeople. Sort of a bonus."

Sommer sighed and tossed the notebook back onto the desk. "That probably finishes it, then."

Compton nodded. "Yeah. Well . . . we'll check his finances and all that—see if he might have had some reason to pick up and run—but I'm not expecting anything to turn up. It sounds like he was the original model citizen." He slid the notebook back into his pocket. "A shame we can't talk to people while they're in the traps. We could ask *him* where his body is."

"Tom Dumata's been working on that since about ten minutes after he joined us," Sommer nodded. "So far he hasn't made even a dent in it." Thoughts of Dumata sparked a memory of the morning— "Incidentally, Frank, as long as I've got you here, have you noticed any changes in the death-row prisoners we've been using for our distance and timeline experiments?"

Compton's forehead creased slightly. "Afraid you'll have to lead the witness, Doctor."

Sommer pursed his lips. "I talked to one of them this morning—Willie Etterly—and I was struck by how much calmer and more polite he was than the first time he came through here. It started me wondering if the experience of going through Soulminder might have some overall rehabilitating effect."

"Um," Compton grunted. "Cute idea. You're talking about the tunnel-and-Light routine, I suppose?"

Sommer shrugged, not entirely comfortably. "It's not an experience you can just toss off."

"So I hear," Compton nodded. He thought a moment. "I can't say I've noticed any massive repentance going on, but then I don't see them as much of them as the line guards and test people do. I'll have someone ask around, see if anyone else has noticed it."

"When you get around to it," Sommer nodded. "It's not exactly top priority at the moment."

"Yeah." Compton hesitated. "What are you going to do about Mr. Pauley?"

Sommer sighed. "We'll hold him as long as there's even a chance of finding his body in a usable state. If we don't . . . we'll have no choice but to release him."

"What about the media? You going to try and keep it quiet?"

Sommer thought about Sands and her ambitions for Soulminder. About her fierce opposition to anything that reflected badly on the corporation—"Again, we have no choice," he said. "People have a right to know that the Soulminder process can only do so much. We're not omnipotent."

"Yeah." Compton got to his feet. "Well, I'm off for the night, sir. You might want to go home, too."

"I will soon. Incidentally, do you have a copy of that newspaper article on Jonathan Pauley that you mentioned?"

"Yeah, we've got one downstairs. You want it?"

Sommer nodded. "I'd like to know as much about him as possible. It might be helpful when we release the story to the media."

Compton's eyes bored into his face for a moment. "OK," he said at last. "Just be careful not to get too involved with the guy. When you can't do anything to help, all it does is tear up your gut. Take it from one who knows."

"OK, Frank, I'll be careful," Sommer said, trying for a smile. "Goodnight."

Compton left. Alone again, Sommer found his eyes drifting to the window, and the street-lit Washington skyline beyond. For decades now, he thought morosely, physicians had had to deal with the problem of when and how to pull the life-support plug on hopelessly terminal patients. Now, barely four years after its creation, it looked like Soulminder was going to have to learn to do the same.

He'd known, down deep, that it would eventually come to this. He just wished it hadn't come so soon.

With an effort, he focused again on the papers facing him on his desk. It wouldn't take more than another hour or so, he estimated, to clear this stack out of the way. Might as well do it now as put it off until morning.

Besides which, there really wasn't any point in going home yet. With the image of Jonathan Pauley's uselessly trapped soul hovering like a ghost before his eyes, sleep was at least another hour away. Possibly longer.

With a tired sigh, he got back to work.

"I was just about to call your house," Sands greeted him as he trudged into the office the next morning. "You all right?"

"I was here till nearly 1:30 this morning," Sommer said, dropping into his desk chair and rubbing his eyes.

"Yeah, I saw the logout," she grunted. "You may be wishing very soon that you'd taken the whole day off. Our friendly neighborhood FBI agent is on his way up."

Sommer frowned. "Royce? I thought you and he settled things with the Mullner files yesterday."

"We did," she said grimly. "This one is worse. It seems Frank's people have found indications that the Soulminder doctor who handled Mario Ca-

vanaugh's transfer in Seattle may have been suborned."

Sommer felt his mouth fall open. *"What?"*

"You heard me." She held up fingers, started ticking them off. "One: the computer's autorecord shows that Dr. Uriah Emerson handled the transfer alone—totally forbidden except in extraordinary circumstances. Two: all the external recording instruments were shut down, or else erased afterward — forbidden under *any* circumstances. And three . . . he seems to have disappeared."

Sommer shook his head. "Hell."

"Yeah, we really needed something like this," Sands agreed sourly. "Give me a hand here, will you?—Royce wants everything we've got on the man."

They had the appropriate files assembled, and were printing up a hard copy, when Royce made his appearance.

"I trust," he said after perfunctory greetings, "that I don't have to tell you how this is going over down at the Bureau."

"I trust," Sands countered, "that you're not going to blame the whole corporation for one man's actions."

"And how do we know it *was* just one man's actions?" Royce demanded. "How do we know more of your people weren't involved?"

"They weren't," Sommer said. "If they had been, the computer's autorecord of the transfer would have been tampered with."

Royce frowned at him. "Explain."

"If Cavanaugh had gotten to a computer specialist or possibly even one of the transfer techs he could have had the autorecord altered or erased, too," Sommer explained. "And if he had, we might still not know he'd been through Soulminder at all."

Royce grimaced. "Yeah, all right. Point. You got that printout?—good. Let me see it."

For a few minutes he skimmed the papers in silence. "So Emerson's been with the Seattle office since it was opened. Sent there from *this* office." He snorted gently. "That sounds like Cavanaugh, all right. Suborns a pigeon, swings out there and gets a duplicate trace made, and then just leaves things sitting on hold for two years until he needs it."

Somewhere in the back of Sommer's mind, an odd thought clicked into place. "Jessica, is Emerson's old Washington address listed on the file?" he asked, scanning the paper.

"It's right here," Royce answered for her, folding back to the first page and pointing. "Bethesda. That's another thing—we know Cavanaugh was living in Bethesda two years ago, too."

"It's also where Jonathan Pauley lived," Sommer said slowly. "The man in Soulminder whose body is missing."

Royce and Sands exchanged glances. "Are you suggesting a connection?" Royce asked.

"I don't know," Sommer admitted. "But the only reason we assumed he hadn't been kidnapped was because there was no ransom note. That and because he didn't have any great sums of money."

"But if he was picked up because he knew something he shouldn't?. . . " Royce said thoughtfully. "Knew something, or else saw something?"

"That's a horrible thought," Sands murmured, shivering.

"Yeah, but it happens," Royce said grimly, getting to his feet. "I'll get some people started looking for connections." He headed for the door; turned back. "Oh, one other thing. Do you have Emerson's Mullner trace on file?"

Sommer looked at Sands. "We should," she said. "All senior Soulminder people are supposed to be protected."

Royce nodded. "You might want to call out to Seattle, then—make sure he hasn't shown up in one of the traps. Cavanaugh's not the sort to leave loose ends dangling." Turning, he left the room.

"Great," Sands muttered, sitting back down at her desk. "Just great. A suborned Soulminder doctor. This thing just gets better and better. Barnswell and his crowd are going to have a field day when this gets out."

Sommer shrugged. "One bad apple in four years is hardly a record of failure."

"It's still one more than it should have had," she snapped. "Compton's going to have to tighten the screws on the employee screening process a couple of turns, that's all. Which reminds me," she interrupted herself, "I was talking to him about half an hour before you arrived, and he tossed out the odd comment about having assigned Hillyard to your rehabilitation project." She arched her eyebrows slightly. "May I ask just what it is you're intending to rehabilitate?"

In the sound and fury of the Cavanaugh thing, Sommer had almost forgotten. "It's something I came up with yesterday morning, before all of this hit the fan." He gave her a quick summary of the possible effects a trip through Soulminder might have on criminals. "It also makes sense financially—"

"No," she cut him off.

He blinked. "I beg your pardon?"

"I said no," she told him firmly. "We're not going to get mixed up in something like that."

Sommer could feel the first wisps of anger beginning to drift across his vision. "And may I ask why not? If Soulminder really *can* be used to rehabilitate criminals—?"

"You're out of step with the nation," she said icily. "No one believes in rehabilitation these days—prisons are for keeping dangerous people off the street."

"Indeed," Sommer shot back. "And it's costing the taxpayers billions of dollars a year to do it. Whereas with Soulminder imprisonment, you could have your felons stacked on cots like cordwood, with fewer security requirements than the average department store. Have you considered *that?*"

"We are not," she said, biting out each word distinctly, "going to allow the name Soulminder to be associated with prisons, or prisoners, or punishment. Period."

For a long moment they glared at each other. "Jessica," Sommer said at last, "I understand your concern for Soulminder's public image. But if we can even *help* people understand that what we do in this life matters beyond it—"

"Soulminder is not some kind of justice machine," Sands said in a voice that accepted no argument. "And it isn't going to become one."

And there was clearly no point in arguing about it further. At least for now.

"Will you at least look over the results of Compton's survey when it comes in?" Sommer asked. "We could always set up a new corporation, without using the Soulminder name."

She hesitated, then gave a reluctant nod. "I suppose it couldn't hurt. Not that Compton should have any spare time to waste on that at the moment," she added archly. "Now, can we get back to one or the other of the more immediate crises at hand?"

"Sure," Sommer nodded. It wasn't exactly the way he'd hoped she would react to the idea. . . . but then, the war was hardly over, either.

She'd come around to his point of view in the end. He was sure of it.

It was like a one-two punch, Cavanaugh thought as the second story broke the next morning. First Soulminder's embarrassment over his own trick maneuver, and now the much grimmer matter of Jonathan Pauley's entrapment in limbo.

A matter that Cavanaugh found just as disturbing as they did. Though for far different reasons.

Disturbing and infuriating both. How in blazes was he supposed to have known that Pauley had been on file with Soulminder? The man hadn't been wearing one of those stupid bracelets, the newspaper article hadn't mentioned it, Digger hadn't picked up on it—

Digger. Right.

For a moment Cavanaugh's vision seemed to swim as he contemplated doing awful things to Digger for fouling up like that. But revenge wasn't going to do him any good. The big question now was whether or not Pauley could still pose a threat to him. If there was any way that they could talk to a trapped soul, for instance; or if they could read all those tangled Mullner-trace curlicues, the way Gypsies could read tea leaves. If there were any way at all that they could find out how Pauley had spent his last days. . . .

If there were, then the authorities should already have closed in on him.

Cavanaugh took a shaky breath, feeling his pounding heart start to calm down again. Too much imagination, he scolded himself. There weren't any loose ends here—Pauley was mute now, just as mute as if he were finally and properly dead.

Strange, he thought, how the image of Pauley trapped there in Soulminder almost made him wince. Again, probably just too much imagination.

It was the middle of the afternoon when Royce's call finally came. It wasn't what Sommer had hoped for.

"What do you mean, no connection?" he asked the agent.

"Just exactly that—no connection," Royce said. "Jonathan Pauley and Mario Cavanaugh have never done business together; have never attended the same clubs or meetings or social functions together; have never lived closer than four miles apart. As far as we can determine, they've never even seen each other. Period; end of file."

Sommer squeezed the phone handset tightly. "There has to be a connection. There *has* to be. The timing is too close to be just coincidence."

"What timing?" Royce retorted.

"Your own numbers show that six other people were in or out of Soulminder traps around the country that same night—and I'll point out that Washington and Seattle are just about as far apart as you can get."

"But there's no way to tell where Pauley actually was when he died," Sommer argued. "He *did* disappear three days before that, remember, and we still don't know what Soulminder's ultimate range is."

"Can you prove Pauley was in Seattle?" Royce asked pointedly. "Or that Cavanaugh had anything to do with his disappearance? If not, it's still just speculation. Loose speculation, at that."

Sommer clenched his teeth. "May I ask a favor, then? Could I make copies of all the public record material in Cavanaugh's file?"

There was a long silence. "What for?" Royce asked at last.

Sommer gestured helplessly. "I don't know. Maybe I can see something that your people missed. Maybe there's some kind of cross-generational thing—Pauley's grandfather going to school with Cavanaugh or something. I don't know; I just don't want to let it go yet."

There was another long pause. "I don't suppose I can stop you from poking around," Royce conceded after a minute. "The public record stuff you could always go out and dig up for yourself."

"Yes, sir," Sommer nodded. "But that would take a lot of time and manpower. And since you already have it all together there?. . . "

Royce snorted; but behind the snort Sommer could hear the recognition that Soulminder was the darling of official Washington. And for darlings the rules could always be bent a little. . . . "Yeah, all right. Not exactly standard policy, but what the hell. I'll make the copies—you're in charge of getting someone over here to pick them up."

"Thank you. I'll have a messenger there within an hour."

"Yeah. And keep in touch—we still want to find that missing doctor of yours."

"So do we. Good-bye."

Reaching over, Sommer keyed off the connection. A punch of a button got him an inside line, and a minute later the messenger had been given his instructions and was on his way. Replacing the handset in its cradle, Sommer looked up.

To find Sands's eyes on him. "Something?" he asked.

"We're branching out into the detective business now?" she suggested coolly.

"If there's anything at all we can do to clear this up—"

"Do *how?*" Sands demanded. "Pauley is *dead,* Adrian—you know it, I know it, the whole world knows it. Hashing endlessly through it isn't going to do either him or us any good."

"Won't it?" he countered. "Then let me point out something that may not have occurred to you yet: are you aware that, for possibly the first time in history, we know the *exact second* an unwitnessed murder was committed?"

Sands opened her mouth . . . closed it again. "We don't know it *was* actually murder, though," she said, a little uncertainly.

"I think it was," Sommer said. "But

even if it wasn't, the point remains that this is a side benefit of Soulminder that no one's ever thought of."

Sands's lip twisted. "One way or another, you're determined to make Soulminder into a justice machine, aren't you?"

"And that bothers you?"

She looked hard into his eyes. "You know how important image is to people. Soulminder's image is that of hope and health and life. The noble side of this world, not the dregs. We're an extension of doctors and hospitals—not prisons, not homicide departments. And that's the way I want to keep it."

"And what about Jonathan Pauley?" Sommer asked quietly. "His company paid good money to make him a part of the Soulminder safety net. If he was murdered, don't we owe all of them at least the courtesy of doing what we can to find his murderer?"

For a long moment they just stared at each other. Sands dropped her gaze first. "Just keep it quiet, all right?" she muttered, turning back to her terminal. "The negative publicity we're already getting is bad enough. I don't want it any worse."

"Right."

For a moment he gazed at her profile, at the hard determination there. Yes, Sands was the drive behind Soulminder: the drive and the spirit and the mind. Leaving Sommer little more than the public image.

And, perhaps, the conscience.

Sitting to one side was the newspaper article on Jonathan Pauley that Compton had sent up. Picking it up, Sommer leaned back in his chair and began to read.

* * *

The package from Royce arrived about an hour later. . . . and Sommer found himself astonished at just how much stuff the FBI had managed to collect on Mario Cavanaugh.

As well as just how thorough they'd been. There were photocopies of Cavanaugh's school attendance lists, from third grade right through college. His high school and college yearbook photos, as well as a listing of some of the clubs he'd belonged to. A summary of his World War II military service, including suggestions that he'd been involved even then with black market and other illegal activities. Two sets of wedding pictures, copies of two divorce decrees. Ads and official papers from each of his various legitimate businesses, and from some that it was hinted had been little more than fronts for money laundering and smuggling operations.

There was more. Much more.

Fascinating reading; but it was a fascination that for Sommer became increasingly tinged with regret and even impotent anger. The Mario Cavanaugh reflected in the records was a brilliant and driven man, the sort of man who would probably have been a success in any field he'd chosen to apply himself to. For all that to have been twisted to the acquistion of power and illegal money struck Sommer as a tragic waste.

"You going to stay late again tonight?" Sands interrupted his thoughts.

Sommer looked up, vaguely surprised to discover it was already nearly six o'clock. Absorbed in his reading, he hadn't noticed the time passing.

"Oh, probably not," he told her with a sigh.

Sands nodded, coming over and surveying the boxes and papers scattered around his desk. "So, any names jump out at you yet?"

He blinked. "Come again?"

"You told Royce you were hoping to find a connection between Cavanaugh's childhood chums and Jonathan Pauley." She picked up one of the high-school yearbook pictures. "Randall Peterson, Rosemary Phelps, Aubry Raystone," she read off the surrounding names. "Seems to me we've got a Phelps with Soulminder—Los Angeles office, I think."

"San Francisco," Sommer corrected her. "I've already run the check; they don't seem to be related."

Sands looked at the piles again, shook her head. "You're really going to wade all the way through this stuff?"

He shrugged. "Until I find something, or prove to myself that there's nothing there to find, or collapse. Whichever comes first."

"I'd vote for collapse, myself," she grunted, gazing again at the photos in her hand. "Certainly had that solid-citizen look back in college, didn't he?" she commented, handing the page back. "I wonder what went wrong."

"I don't know," Sommer sighed, looking at the picture himself. She was right: with his dark hair and thin, intensely earnest face, Cavanaugh should have been a future business or political leader. Not a—

Abruptly, Sommer's thoughts broke off. There was something about that face. . . .

He looked up. Sands was already at the door— "Hold it, Jessica," he called.

She paused, her hand on the doorknob. "You find something?"

"I don't know," he frowned, digging carefully through the pile. "Come here a minute, will you?"

He'd found the newspaper photo of Pauley by the time she reached the desk. "Take a look," he invited, holding his breath. "Tell me what you see."

Frowning, she looked at the two pictures. The frown deepened, and she held them side to side. "They could be brothers," she agreed. "Almost twin brothers, for that matter. I hope you're not suggesting Pauley and Cavanaugh are related—Royce would have to be an idiot to have missed something that obvious."

Sommer licked his lips. "No, not related. Not . . . exactly."

She stared into his face. . . . and slowly, her puzzlement dissolved into a look of horror. "Oh, my God," she whispered, her face turning almost green. "You're not suggesting that Cavanaugh?. . . "

Sommer felt a little sick himself. "Why not?" he asked.

"But it's—" she floundered. "It's *impossible*. . . . isn't it?"

"I don't know," Sommer said grimly. "But I think we'd better find out."

Sands hissed between her teeth, her expression of repugnance vanishing into dark determination. "Damn right. Let's get to it."

Royce frowned at the photos for what seemed like a long time before finally laying them down on the desk. "Yes, I agree that Pauley looks a lot like Ca-

vanaugh when he was a young man. I hope that's not all you dragged me over here for.''

''That's just the starting point,'' Sommer shook his head, a mild wave of dizziness shooting through him as he did so. Four cups of coffee on top of less than five hours of sleep was already starting to take its toll, and he wished they could have put this off a little longer. But with Pauley's life hanging in the balance. . . . ''The pictures were what got me wondering if maybe Cavanaugh threw a curve none of us were expecting.''

''That being. . . ?'' Royce asked with clearly forced patience.

''Last night we did a complete examination on the computer autorecord of Cavanaugh's transfer,'' Sands spoke up. ''We discovered a couple of anomalies that no one had paid attention to before.''

She leaned over to hand Royce the hard copies. ''I've combined the event timelines from Seattle and the office here,'' she continued. ''Note that Cavanaugh entered Soulminder at precisely 12:51 last Monday morning, and was transferred back at 3:14.''

''Two hours and twenty-three minutes,'' Royce shrugged. ''So? You've kept bodies alive a lot longer than that.''

''With full life-support,'' Sommer agreed, ''and with the use of neuropreservatives. Without them the brain cells start to degenerate within a few minutes, and for most people irreversible damage begins well within an hour. For a man Cavanaugh's age, it would happen even faster.''

''So he had black market neuropreservatives.''

Sommer shook his head. ''That's just the point: he didn't. No black market neuropreservatives; no neuropreservatives of any sort. The body was brought in, connected to Soulminder, and the soul transferred. A quick in-and-out operation.''

''That's not just a guess,'' Sands added. ''The autorecord gives a complete procedural timeline. There *was* no flushing of neuropreservative residue.''

Royce had a strange, almost pained expression on his face. As if he saw what they were driving at but didn't want to believe it. ''So why isn't he dead?'' he demanded.

Sommer took a deep breath. ''Because he didn't transfer into his own body. He transferred into Jonathan Pauley's.''

He'd expected Royce to be amused, angry, or just plain disbelieving. But the other passed up all the obvious reactions. For a long minute he just looked back and forth between them, his eyes seeming to measure them. Then, still silent, he looked back down at the combined timeline Sands had prepared. ''I presume you've double-checked all these numbers?'' he asked at last.

Sands nodded. ''Against two independent clocks. Pauley entered the Washington Soulminder at exactly 6:11, 3:11 Seattle time. Three minutes before Cavanaugh was transferred.''

Sommer shivered. ''He must have died right there on the transfer table.''

Royce's eyes dropped back to the timeline, his fingers worrying gently at the edge of the paper. ''It's an interesting theory,'' he said. ''But that's all it is: a theory.''

''There are other indications,'' Som-

mer told him. "Emerson did the transfer alone, remember—*and* he had the videocameras off. Why would he do all that if it was Cavanaugh's own body they were transferring into?"

"To keep us from knowing Cavanaugh had been through Soulminder?" Royce suggested doubtfully.

"Except that the computer autorecord would tell us that," Sommer reminded him. "Besides, he could easily claim ignorance that he'd done anything wrong—the Seattle system didn't have your red light on it."

Royce shook his head. "This is crazy. A soul isn't just some—"he groped for words—"some interchangeable computer card or something. You can't just pull one out and plug another one in."

"Cavanaugh did it," Sommer said. "Dr. Sands and I are convinced of that."

"Well, I'm not," Royce said doggedly. "It's still just a left-field theory—and with all the witnesses having so conveniently disappeared, that's what it's going to stay: a theory."

Sommer glanced at Sands. "Except," he told Royce carefully, "that not *all* of those witnesses have disappeared."

Royce stared at him . . . and Sommer could see in his eyes that he understood. "You're not serious."

"Deadly serious, Mr. Royce." Sommer braced himself and got to his feet. "If you'll come with us . . . we're going to ask Jonathan Pauley what happened to him."

The preparations were already complete, and they entered the experimental transfer facility in the lab wing to find five uncomfortable-looking people waiting for them. A doctor, three transfer techs . . . and a quiet, dark-haired young man.

"Special Agent Royce, this is George Gerakaris," Sommer did the introductions. "One of our research people."

Royce and Gerakaris exchanged nods. "Why him?" Royce asked.

"We did a computer comparison of all our employees' Mullner traces," Sands explained. "Mr. Gerakaris's came out the closest to Pauley's."

Royce eyed Gerakaris. "And they asked you to do this?"

Gerakaris smiled, a smile that didn't wholly relieve the tension around his eyes. "I volunteered, Mr. Royce," he said, his voice showing just a trace of an old Greek accent. "I'm a scientist, after all—how could I pass up a chance to take part in such an experiment?"

Royce shifted an uncomfortable frown back to Sommer. "You realize, I hope, that what you're about to do is technically murder."

Sommer realized it. Realized it exceedingly well. "Mr. Gerakaris has signed a release," he told Royce, keeping his voice even.

"Which may not be worth a damn, legally," Royce growled. He looked at Gerakaris, back at Sommer. "Have you discussed this with your legal department?"

Sommer shrugged. "They're not exactly happy about it," he said candidly, "but they say the release will cover us reasonably well. They also talked a lot about the right-to-die statutes, but I wasn't sure exactly how those applied."

Royce snorted gently. "They don't

apply at all. Not really." He grimaced. "This is nuts, Sommer. You're putting your personal and corporate necks—not to mention mine—on the block here without even a scrap of proof that Cavanaugh tried this. Let alone that it worked."

"Oh, it worked," Sands said. "It had to. Otherwise, why did Emerson disappear?"

"Because Cavanaugh didn't want him to talk, of course."

"Naturally," Sands agreed. "But then why hasn't Cavanaugh simply gone ahead and killed him?"

Royce started to speak . . . paused. "You tell *me*," he challenged.

"Because Cavanaugh *knows* that souls can be transferred to different bodies," Sommer said. "With Emerson on file at Soulminder, killing him would just put him back into our reach."

"By that logic, Pauley was a lousy choice," Royce argued. "Even if I grant you that Cavanaugh was vain enough to try and grab back his youth when he saw Pauley's picture, he wasn't stupid enough to let vanity get in the way of common sense."

"Except that Pauley seldom wore his Soulminder bracelet," Sands reminded him. "Cavanaugh probably never knew he was on file here."

"And what if Emerson disappeared because Cavanaugh died on the operating table and the doctor's taken his guilty conscience into hiding?" Royce countered.

Sommer started to speak; but it was Gerakaris who answered. "It's a calculated risk, Mr. Royce," he said firmly. "But all of us are willing to take that risk."

"If you want," Sands offered, "you can wait outside until it's over."

Royce sent her a glare. "If it doesn't work, I'm still an accessory to murder," he said shortly. "It's not going to matter a damn where I'm standing at the time." He jerked his head toward Gerakaris. "Get on with it."

It was as close to assent as they were going to get. Turning, Sommer gave the nod to the others.

And watched as they prepared Gerakaris to die.

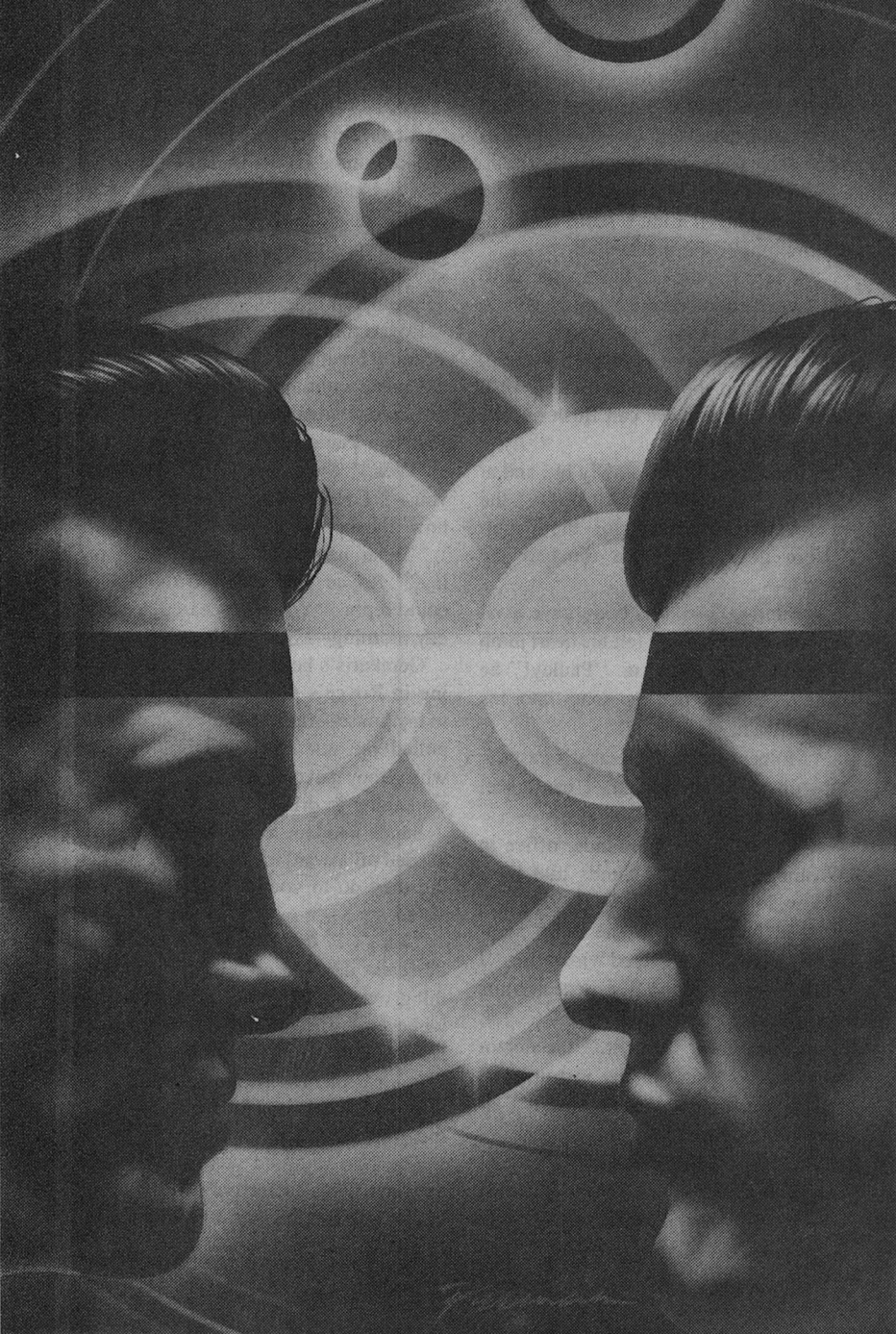
It was a simple enough procedure. Gerakaris got onto the transfer table, settling himself as comfortably as possible as the techs wheeled the instrument tray and backup life-support gear into position. Last came the waveguide cable and headband electrodes that would—if all went well—provide the path for Jonathan Pauley's soul to enter Gerakaris's body.

"You all set, George?" the supervising doctor asked, leaning over the table to look at Gerakaris.

Gerakaris's hand lifted from the table, made a surreptitious cross: forehead, heart, right chest, left chest. Eastern Orthodox style, Sommer noted. Pauley, he remembered, had been a solid Catholic. How much of the similarity in their Mullner traces, he wondered distantly, had come from the two men's religious convictions? "I'm ready," Gerakaris said, dropping his hand to his side again and closing his eyes.

The doctor looked at Sands, got a confirming nod, and picked up the hypo. With just the slightest hesitation, he gave Gerakaris the injection.

Gerakaris inhaled sharply, and Som-



mer found himself unable to watch. Turning his head, he found himself staring at the medical readout panel . . . and even as he watched, the life signs disappeared.

Sommer swallowed against the lump in his throat. It didn't seem to help. "How long?" he murmured.

"A few minutes," the doctor said, his own attention on the instruments and his assistants' work. "I'm going to give him a small dose of neuropreservative, just to be on the safe side, and we'll have to wait until we can flush out the residue."

The minutes ticked slowly by, and at last they were ready. "All right," the doctor said, reaching for the panel. "Here goes. . . ." He touched the switch—

Abruptly, Gerakaris body gave a violent twitch. Sommer felt his heart jump in sympathetic response. "Pauley!" he called, tension putting snap into his voice. "Are you there?"

"Mother of God," Gerakaris gasped. "I—oh, God in heaven, I can't see. Where—where am I?"

"You're in the Soulminder office in Washington, D.C.," Sands told him. "How do you feel?"

"I'm burning up," the other managed. His body shivered violently. "I can't see—everything's just a blur. Have I gone blind?"

"Don't worry about it," the doctor advised, his eyes on his instruments. "This sometimes happens, and it's always temporary."

Off hand, Sommer couldn't remember such a side effect ever happening before. But the assurances seemed to help, and Gerakaris calmed down a little.

No. Not Gerakaris. Pauley.

A cold shiver ran up Sommer's back. It had worked. It really had worked. A man's soul had been transferred into another man's body. . . .

He turned to find Royce gazing rigidly at the man on the table. "Royce?" he prompted quietly.

Royce threw him a sharp look, took a careful breath. "Mr. Pauley," he said, the name coming out with noticeable difficulty. "Are you—I mean, you *are* Jonathan Pauley?"

"Yes," the other said. "Why do you—? I feel strange, Doctor. Is this how it's supposed to feel?"

"What happened to you, Mr. Pauley?" Royce put in before the doctor could reply. "You disappeared last Friday morning—what happened to you?"

Gerakaris's head turned, eyes squinting in Royce's direction. "They came to my house—right into my house—and pulled me out of bed. I don't know why—they never told me. Can I have something to drink?"

Sands nodded, and one of the techs hurried off toward the prep room. "What did they do to you, Mr. Pauley?" she asked.

"Uh . . ." Pauley frowned in thought. "I really don't know. They put something over my mouth . . . and when I woke up I was in the back of a van." He shook his head, blinking his eyes as if to clear them. "But they kept giving me stuff, and I kept falling asleep. But then—"

The tech returned with a paper cup of water. The doctor got a hand under Pauley's head, raising it enough to let

him take a few sips. "Go on," he prompted. "Then?. . . "

Pauley's eyes suddenly looked haunted. "There was a man," he whispered. "An old man. Very—" He swallowed. "He came up and looked at me. Asked me some questions."

"What sort of questions?" Royce asked, digging into his briefcase.

"He asked . . . whether I had any health problems," Pauley said, his voice vaguely confused. "It didn't make any sense."

"Is this the man?" Royce asked, stepping close to Pauley and holding up a picture.

Pauley squinted. "Yes. Oh, Mother of God, yes." His hand came up, crossed himself shakily. Forehead, heart, right chest, left chest. "He was . . . evil. I could feel it. He said . . . he said I would do just fine. And then they took me back to the van and drove me around—"

Abruptly, Gerakaris's face twisted with emotion. "And then they—they killed me!"

The words seemed to ring in the room. Pauley groped for the doctor's arm, found it and gripped it tightly. "Soulminder," he breathed. "It's just like purgatory. You're dead; but you can't get into heaven."

The doctor looked at Sommer. "Dr. Sommer?. . . "

Sommer glanced at Royce, got a confirming nod. "Mr. Pauley," he said, trying desperately to find the right way to say this, "I'm afraid we're going to have to put you back into Soulminder for a little while. There's—" He looked at Sands helplessly.

"There's a problem with your body," she said. "A medical problem—nothing serious, really: probably why you're feeling so strange at the moment. OK? You'll be out again soon—I promise."

Pauley's face stiffened. "You're going to kill me again?" Again, the quick up-down, right-left swipe of hand across chest. "Oh, please. Please, Doctor—"

"I'm afraid it's necessary," the doctor said firmly. "Don't worry—it'll be all right."

He picked up the hypo, set it against the arm—

And Pauley raised his hand in front of his eyes—eyes that were suddenly filled with confusion and horror. "My *hand*—" he gasped.

Sommer braced himself for the reaction. . . . a reaction that never came. Without a sound, Pauley's eyes closed, the hand fell back. . . .

And for the second time in ten minutes, the instruments registered death.

The doctor reached for a second neuropreservative hypo, injected the body with it. "It'll be another couple of minutes, Dr. Sommer."

Sommer nodded and took a shuddering breath, feeling his sweat-soaked shirt clinging to him as he did so. It had worked. It had actually worked. . . .

And he'd been right. Cavanaugh had indeed stolen another man's body.

The thought made Sommer sick to his stomach.

A subtle breeze brushed over his skin as Royce moved up beside him. "Congratulations, Dr. Sommer," he said quietly, a sour tinge to his voice. "You and Soulminder have just created a brand-new crime. Body theft."

Sands turned to throw a frown in Royce's direction. "I hope you're not

going to try and blame *us* for this perversion of Soulminder's capabilities," she growled.

"Why not?" countered Royce. "It's your machine, isn't it?"

"It doesn't matter whose fault it is," Sommer verbally stepped between them. "The question is how we're going to keep it from happening again."

"Dr. Sommer?" the physician at the table spoke up. "We're about ready to transfer Gerakaris back."

"Yes, go ahead," Sommer told him briefly, turning back to Royce. "It seems to me that what we're talking about is a stronger security arrangement for both the initial Mullner tracings and the transfer rooms themselves. We'll get Frank Compton looking into what would be appropr—"

"Adrian!" Sands cut him off.

He spun back to the table. One look at the instruments was all he needed. "What is it?" he snapped, taking a long stride to stand at Sands's side by the table.

"It's not taking," the doctor said tightly, hands hovering uncertainly over the control board. "Gerakaris's soul isn't remelding with his body."

Sands swore under her breath, stepping around the table and elbowing the doctor aside. "Can you tell what's causing it?" Sommers asked her.

She shook her head. "This hasn't ever happened before," she gritted out.

"Could Pauley have done something to the brain chemistry or Mullner topography while he was there?" Sommer suggested.

The muscles in Sands's cheeks tightened visibly. "I hope to hell that's not it. Because if it is. . . ."

She left the sentence unfinished. Consciously unclenching his own teeth, Sommer shifted his eyes to the bank of readouts. "Let him go," he said quietly.

Peripherally, he felt all eyes turn to him. "We've got no choice," he said into the silence. "All we're doing is building up to massive physical trauma in the brain. We'll put the body on full life-support, let it rest a while, and then try again."

Sands took a deep breath. "All right," she said, reluctantly but clearly with no better option in mind. "Here goes. . . ."

The readout lights changed, turning from green to amber to red. . . . and the body again died.

"Neuropreservatives," Sands ordered. The doctor moved to comply, and she stepped away from the table to the computer terminal off to the side. Sommer held his breath. . . . "The trap caught him," she confirmed, straightening up. "He's back in Soulminder."

Sommer nodded, turning back to find Royce's eyes on Gerakaris's motionless form. The eyes of a man seeing *accessory to murder* on his record. "Don't worry, it'll work," he assured the agent, trying hard to sound confident.

With a visible effort, Royce broke his gaze away from the body. "I hope so, Doctor," he said, looking Sommer square in the eye. "Because if it doesn't—if you can't put a soul back into a body after someone else has been there—then finding Cavanaugh won't buy us anything but the chance to hang another murder on him. Pauley will still be dead. . . . and he'll stay that way."

Sommer felt his stomach tighten. "I know."

* * *

The Soulminder file on Jonathan Pauley was slender, consisting of nothing more than the usual information taken from those who were willing to pay large sums of money for the security of Soulminder's safety net. Sommer had gone over both the file and Pauley's newspaper article three times and was midway through a fourth reading when the call finally came.

Sands was ready to try the Gerakaris transfer again.

He arrived downstairs to find the same team assembled as before, along with Tom Dumata and a handful of Soulminder's other top people. "Adrian," Sands nodded to him as he strode into the room. "Anything new come up on the Mullner analysis?"

Sommer shook his head. "The computer's still checking over the third-order effects, but there was nothing on first or second. I think our original analysis was valid, that there were no inherent incompatibilities between Pauley and Gerakaris."

Sands grunted satisfaction. "Good. That gives that much more weight to the physiological analysis."

"The neuropreservatives?"

She nodded. "It's looking more and more like that's the culprit. The simulations still go crazy when we try putting two doses of the stuff in that closely together, even when the usual flushing procedures are followed."

Sommer felt his throat tighten. "Possibly just one more of the lovely psychological side-effects neuropreservatives create."

"Yeah," Sands grunted. "Instead of completing the transfer into that emotional snake pit, the soul simply refuses to reconnect at all."

"Or can't do so even if it wants to," Dumata put in from the readout panel. "I think we're about ready, Dr. Sands."

Sands looked at Sommer, seemed to brace herself. "Let's do it."

It was, for Sommer, a distinct and welcome anticlimax. On the table Gerakaris's body jerked and gasped. . . . and then the Soulminder indicators went out, and he was back.

"Mr. Gerakaris?" Sommer asked as the other blinked his eyes against the overhead lights. "How do you feel?"

"O . . . OK," Gerakaris grunted, his voice sounding strained. "That was—God above, that was strange. How long was I in there?"

"Longer than we originally planned," Sands said soothingly, "but it worked out all right."

Gerakaris squinted at her, suddenly tense. "There was a problem?" he asked, his hand tracing a surreptitious up-down, right-left across his chest.

And Sommer found himself staring at that hand. Staring at the imaginary cross Gerakaris had just traced across his chest.

Staring at the mental image of that same hand, and that same motion, an hour earlier. . . .

Someone was calling his name. "I'm sorry," he said, bringing his thoughts back with an effort and focusing on Sands. "What did you say?"

Sands was frowning at him. "I asked if you wanted to ask Mr. Gerakaris any questions before we took him over to the examination room," she repeated.

The question spinning through Sommer's mind almost came out . . . but

this wasn't the time or the place to bring it up. Even if Gerakaris had any chance of answering it.

But perhaps there was someone who could . . . "No," he told Sands. "There'll be time enough to talk about the experience after we're sure he's all right. Ah . . . why don't you go ahead and start the exam—I'll join you in a few minutes."

Sands's frown deepened, and he could tell she very much wanted to ask him what was bothering him. But she too knew better than to discuss whatever the problem was in front of Gerakaris. "All right," she said, striving to keep her voice casual. "Give me a hand here, Doctor?. . . "

Sommer left, breaking into a jog as soon as he was out of the room. Back in his office, he read one last time—very carefully—through both Pauley's Soulminder file and the newspaper article. Then, just to be sure, he called up the videotape of Pauley speaking through Gerakaris's body.

There was no mistake.

He sat there for several minutes, thinking it through. Then he reached for the phone and punched a number.

A neutral voice answered on the third ring. "FBI."

"This is Dr. Adrian Sommer at Soulminder," Sommer identified himself. "I'd like to talk to Special Agent Royce. Tell him it's important."

"One minute."

The phone went blank; and Sommer had just enough time to pick up the Pauley article again before Royce came on. "This is Royce." The agent sounded tired.

"We just got Gerakaris out of Soulminder," Sommer told him. "We're checking him over to be on the safe side, but it looks like the transfer was completely successful."

"Yeah, your man Dumata just called to tell me that," Royce grunted. "Congratulations; and I'll tell you right now that you were damn lucky."

"No argument," Sommer agreed soberly. "How's the search for Cavanaugh going?"

He could almost hear Royce shrug. "Way too early to tell. We've sent Pauley's photo to the local authorities, but we can't make too much fuss or we're likely to spook him."

"I understand." Unconsciously, Sommer braced himself. "If I may offer a slightly long-shot suggestion, I think there's a place—or, rather, a group of places—that might be worth staking out."

He explained where. And then, of course, he had to explain why.

The two men were waiting by the door as he filed out with the others — young men, Cavanaugh saw, with the look of FBI agents stamped all over their faces. For a brief moment he considered trying to flee . . . but the thought was pure reflex, without any real force of will behind it. Their eyes were locked on him, now; they'd identified him, and there was no point whatsoever in making a fuss.

The game was over, and he'd lost.

The young men moved forward together as he approached, coming to stand directly in front of him. "Mario Cavanaugh?" the elder of the two asked quietly.

Again, there was nothing to be gained by lying. "Yes," Cavanaugh nodded.

"FBI," the other said, holding his ID cupped in his hand. "Will you come with us, please?"

"Of course." Cavanaugh glanced around at the others milling about; but if any of them had overheard the brief conversation they made no sign of it. "Thank you for not—well, for doing this quietly."

The agent cocked a slightly puzzled eyebrow at that. "No problem," he said evenly. "This way, please."

Walking between them, Cavanaugh stepped through the large ornate doors and out into the sunlight. The game was over, and he'd lost. . . . and yet, he felt none of the angry frustration he would have expected to feel at such failure.

Instead, his mind was filled with genuine relief. Relief that the lie was finally over . . . and mild surprise that he should feel that way.

Sommer hung up the phone, and for a long moment the office was silent. "Well?" Sands asked at last.

"They're finished with their interrogation," Sommer told her. "Royce will be bringing Cavanaugh back here in about half an hour. For his execution."

The word hung heavy in the air. "He destroyed his own body, Adrian," Sands reminded Sommer gently. "He doesn't have any claim to the one he's using now."

"I know." Sommer sighed. "It just seems . . . I don't know; wrong, somehow. Execution without due process, or something."

"It can't be helped," Sands said, a touch of impatience creeping into her voice. "Pauley has rights, too—and a lot better claim to those rights than Cavanaugh has."

Sommer grimaced. "You sound like Senator Barnswell."

"Well, maybe for once he's right," she growled. "Even Barnswell can't be wrong *all* the time."

"I take it you haven't seen the bill he's preparing to introduce into the judicial committee."

"As a matter of fact, I have," Sands said calmly. "I think it's a good idea."

Sommer stared at her. "I thought you were the one who didn't *want* Soulminder used as a justice machine."

"No, no—I was the one who didn't want it to be a prison substitute," she corrected him. "Offering maimed victims the temporary or permanent use of their assailants' bodies is something else entirely. *That's* justice, Adrian. More to the point, it's justice that fits the mood of the country."

The justice of judicial vengeance. *An eye for an eye, a tooth for a tooth. . . .* "Oh, it fits the mood, all right," Sommer admitted wearily. "Fits it perfectly. The only problem is that it won't work."

"Oh, it'll take some overhauling of the legal system—"

"No!" Sommer snapped. "It *won't work*. Period. Royce was right, Jessica—the soul isn't some kind of standard module you can pull out of one body and plug into another. Habits, memories, temperament—they're all locked into the brain and body chemistry, as much as they are into the soul itself." He took a deep breath. "When Pauley was in Gerakaris's body, he

crossed himself, twice. But he did it Eastern Orthodox fashion, not Catholic. The way *Gerakaris*, not Pauley, would have done it.''

Sands's eyes were steady on him, the lines around her eyes tight. ''That may not be all that significant,'' she suggested slowly. Carefully. ''Maybe a small habit like that . . . I mean, they *are* both very religious men, after all.''

Sommer closed his eyes briefly. ''Do you know where they picked Cavanaugh up?''

''No, I didn't read the—''

''They picked him up in a church. St. James Cathedral, to be exact. Attending Sunday Mass.''

For a long minute the room rang with silence. A strangely horrified silence. ''Are you suggesting. . . ?'' Sands's question faded away unfinished.

Sommer nodded. ''There doesn't seem to be any doubt about it. A totally amoral criminal boss attends church, and according to Royce, was actually eager to clear his conscience of all the slime he's participated in.

''Tell me, Jessica . . . what do you think would happen to a normal person transferred via justice machine into the body of a psychotic killer?''

''Oh, my God,'' she whispered, very quietly. ■

FUTURES

(continued from page 105)

weapons. Like *Zelda, Link* comes with a battery that will store games for up to five years. While not as much outright fun as *Zelda, Link* is a good product for showing the young Nintendo fans that there are other horizons in gaming.

Other, more involved games are on the way. *Ultima*, the famed role-playing game series from Origin Systems (designed by Lord British) will be available for the Nintendo from FCI. *Defender of the Crown*. the smash computer game from Cinemaware, will be released as a Nintendo product from Konami, as will Cinemaware's *The Three Stooges* (due out from Activision). Jaleco's realistic baseball game, *Bases Loaded*, will be followed by exciting basketball (Hoops) and soccer (Goal) games.

But there was one very special product at the Nintendo mega-display that caught my eye. It looked like a helmet of sorts, and there wasn't a crowd of people around it. I walked over to the helmet and read that it was a new controller designed to be used by disabled children. All the gameplay is controlled by movements of the head.

Now, of course we're talking about video games here. Not exactly the most important thing in the world. But when I saw the helmet I thought of the special children excluded from all this video mania. These days, the Nintendo is almost as much a part of being a kid as yo-yos and smoke snakes were when I cruised the streets of Flatbush.

I doubt whether Nintendo will make a killing on the helmet. But someone in their office took some time to think about something other than the next game. And they weren't hyping the helmet at the show, pushing it as a public relations item.

But it's there, and if you know someone who could use it, contact me at *Analog* and I'll put you in touch with someone at Nintendo who can help you get the helmet controller. ■

the reference library

By Tom Easton

Prentice Alvin, Orson Scott Card, TOR, $17.95, 384 pp.
Being Alien, Rebecca Ore, TOR, $?, ? pp.
The Quest for the 36, Stephen Billias, Popular Library (Questar), $3.95, 210 pp.
Striped Holes, Damien Broderick, Avon, $2.95, 179 pp.
The Knight and Knave of Swords, Fritz Leiber, Morrow, $17.95, 303 pp.
Still Life, E. E. Horlak, Bantam, $3.95, 256 pp.
The Warlock's Companion, Christopher Stasheff, Ace, $3.50, 224 pp.
Dreams of Gods and Men, William T. Quick, NAL, $?, 302 pp.
Perchance, Michael Kurland, NAL, $?, ? pp.

Orson Scott Card's *Tales of Alvin Maker* may have struck you as fantasy—excellent, ambitious, and charming fantasy in the Appalachian vein but fantasy nonetheless—when you read the first two books in the series, *Seventh Son* and *Red Prophet*. Now the third is out, and I submit to you that **Prentice Alvin** redefines the series as science fiction.

How can I possibly say that? Card's story concerns a nineteenth-century America in which the folk magic of knacks and hexes all works, and his hero, Alvin, is a boy whose knack is the knack of knacks—he is, at least potentially, a Maker such as the world has not seen in the last two millennia. The Great Enemy, whom we too easily identify as the devil, is the Unmaker, the foe of Making, of creation, of god. Because the Unmaker (often in the form of flowing water) is so set on destroying Alvin, the boy is clearly Christ come again.[1]

So where's the SF? Think about it: Card has told us a lot in the first two books. Now he becomes all but explicit: The Unmaker is entropy, the daemon

1. In other words, here we have another of those millennial books whose coming marks the approach of the year 2000.

of time and cosmology, expressed in things as ordinary as flowing water and the erosion it causes. This is a uniquely scientific thing to find in fantasy, as is the stress in *Prentice Alvin* on education. Consider: Peggy, the torch who has from a distance long protected Alvin, runs away from home as Alvin approaches Hatrack River for his apprenticeship to the blacksmith. She loves the boy but knows that she must be worthy of the man's love, and that she must help him become worthy of her love. She seeks education, and in due time "Miss Larner," too old to be Peggy but laden with hexed beseemings, comes to school the older Alvin. In a small house set above a spring where water—the Unmaker, remember—no longer runs, she teaches him to read and figure, but also she tells him of philosophy and physics. Then he can bring science to the magic of his Making and begin to become a Maker indeed.

It's the science of magic, and the magic of science. It's the viewing of reality as a single fabric, which if it has magical—or scientific—elements must reconcile those elements with the laws and facts of science—or magic. It's the uniting of mysticism and rationality in service to the search for a utopia in which each human being will spontaneously and naturally fit his or her actions to those of the surrounding others and to the social good, in which each human being is a Maker, creative, opposing entropy, dedicated to increasing the domain of life and design at the expense of the domain of death and chaos.

If you get the impression that I think it's good stuff, you're quite right. In fact, I think it's such good stuff that I'm going to go way out on a limb and say that in this series Card, and science fiction as a genre, just may have the best candidate to date, in all of American literature, for *THE* Great American Novel.

Or maybe it's just the Great American Mormon Novel. Card *is* a Mormon, after all, and his Crystal City, his City of God, is both an American and a Mormon dream. Furthermore, there are some intriguing reflections of Mormon doctrine in the book, such as the notion he credits to the Unmaker that blacks cannot be saved until they are sufficiently hybridized with whites. Laid intriguingly against this is the change Alvin works in the mulatto boy, Arthur, to save him from the Finders who would return him to the slavery from which his mother fled. This change begins in the skin but then goes deeper, to involve Arthur's very DNA and then to rob him of something that makes him most truly him.[2]

What makes it so great? It's an absorbing, entertaining story that speaks to many facets of human life. But the guarantee of greatness is that Card has loaded it with so many levels of meaning that it will permit exegesis by generations of graduate students. And I speak only partly tongue-in-cheek. Read the books, and judge for yourself.

In Rebecca Ore's first novel, *Becoming Alien*, Tom, a young hillbilly, went to the stars to adapt himself, despite a bone-deep human xenophobia, to a multi-species alien culture. He succeeded, but then he had a further task of adaptation ahead of him. He was young when he left Earth, so young that

2. The Mormon doctrine, stated explicitly in Joseph Smith's *Book of Mormon*, is that if your skin is dark, that is because your ancestors sinned, and as soon as you stop sinning, as soon as you are truly saved, your skin will turn white. Even though the *Book of Mormon* is supposed to be infallible scripture, the Mormon elders have wisely repudiated this idea. Is it any wonder that I personally consider the *Book of Mormon* an early and marvelous work of pure fantasy?

he had not yet truly adapted to human society. Now he must backtrack in his life to learn what was before, by circumstance, denied him.

This is the meat of Ore's second novel, **Being Alien**. She begins by reminding us that Tom was not the only human among the aliens, for there was also a 500-year-old colony of Tibetans, and he indeed tried to adapt to their society. But he failed, and his mentors decided that he must return to Earth, to, in fact, a Berkeley of conventionalized radical chic, there to study Japan's adaptation to the invasion of the alien West, to meet aliens who have done their best to adapt to human society, to meet a woman, Marianne, who may become his wife, and eventually to bring other humans back with him, not forgetting to rescue his drug-using, drug-dealing brother Warren from prison.

There is humor here, and a clean prose, and engaging characters. What is missing is the freshness and verve of *Becoming Alien* that so impressed me and many others. What is also missing is the kind of self-containment that lets a sequel stand on its own. Ore begins awkwardly, demanding that you have read the first book and recall well its basic issue, the difficulty of coping with hard-wired xenophobia. But the tale picks up its pace soon enough, and we soon begin to suspect that now her issue is how humans must cope with other humans, despite the same sort of wired-in distrust and fear that we call xenophobia when we look at aliens. In other words, we think, she is saying that humans are as alien to each other as to any sentient bird or bat, and xenophobia thus presents as many problems to our one-species culture as it does or can to any multispecies culture. There is also the possibility of reading the novel as a parable of SF readers, who adapt when young to aliens and alien (or nonconventional) ways of thought in their and our favorite literature but must eventually grow up and adapt to mundane society.

Yet her true theme is something else. The answer to human conflict, she says, is to embrace the strange. Xenophiles don't fight wars.

Is xenophilia truly an option for humans? For some, certainly. Consider SF fans. Even outside that select group, xenophilia may last into maturity, for when Tom brings Marianne among the aliens, he also brings her sister Molly and her husband Sam, black and white. These two people, by bridging barriers of alienness on Earth, demonstrate a rare xenophilia so basic to their personalities that their marriage quickly falls apart when they confront something more foreign to their selves than color. Sam joins up with the Tibetans (in fact, with Tom's prior mate, Yangshenla). Molly falls for a bat. Unfortunately, these developments do surprise us; there is no hint that Sam and Molly are so driven by xenophilia, and there should be.

Ore tells us that xenophilia is, in essence, simply open-mindedness. But not the kind of open-mindedness you get from drugs—that is more akin to the holes in your head you get from holding a shotgun to your brow and pulling the trigger. Even alien wonder medics cannot save Tom's brother.

There will, Ore writes me, be a third volume. I suspect that it must take her themes to some kind of resolution, but with the aid of a new generation of remarkably well-integrated, xenophilic characters. In *Being Alien*, Marianne gets pregnant and joins a multispecies "birth group" whose members give each other emotional support and physical assistance, and whose children will surely be drawn together by the link among their mothers. I expect that Tom's and Marianne's child, who will

be raised from birth among aliens, will be the central character, that Sam's and Yangshenla's child will also be on center stage, that . . . . Ore is well embarked on a deep and thorough exploration of xenophobia and a search for answers to it. I am looking forward to the end result.

The Blooper of the Month Award has to go to Stephen Billias's **The Quest for the 36**: At one point, Billias describes a little old lady, who shows no signs of great pain or suffering, as being "bent over with peritonitis."

Peritonitis is an infection of the abdomen outside the intestines; it can come from being gutshot, perforated ulcers, and other such drastic assaults on the body. Little old ladies who walk around all bent over tend to have *osteoporosis*, softening of the bones. And that, ladies and gentlemen, is presumably what Billias *meant* to say. 'Tis a pity that Questar doesn't employ any copy editors or proofreaders worth the price of a dictionary.

The little old lady in question is one of three who recruit booking agent Dexter Sinister to find the 36 Just Men (and women) whose sheer goodness and virtue keep the entire world from sliding down the tubes. The problem is that the world's wickednesss is getting a bit much, and there must be, for the first time in history, a conference of all 36. Velma, Lillian, and Agatha are three. Others come to Dexter, but he must go forth to hunt down—in Maine, Alaska, Tonga, a nuthouse—a few more. Word of the ingathering leaks out, the world turns hopeful, the three dozen take over Yankee Stadium, and suddenly Dexter Sinister himself must somehow say why the world is worth saving.

It's a nobly intended tale, and one that some writers might have handled at great length, with great philosophical seriousness, striving for the truth of deeply probing analytic thought. But it has been said—by whom? Groucho? George Burns?—that comedians come as close to the truth of deepest reality as any philosopher, and they surely reach more people.

This is the spirit in which Billias works. *The Quest for the 36* is a jolly tale, well paced and funny and entertaining.[3] It's a good evening's read, and if it insists on saying something serious while the reader chuckles, then perhaps the reader will painlessly absorb the point and be the better for it.

Australian Damien Broderick offers us another entertainment in **Striped Holes**. The story is simple enough: In our contemporary Australia, an alien who resembles a slice of bread (sliced lengthwise) materializes in the living room of male chauvinist carnikopf Sopwith Hammil and announces that the sun will be turned off shortly. Sopwith has three hours to find a mate and qualify for rescue. Unfortunately, his girlfriend has no intention of settling for anything less than a high church shindig. Fortunately, Sopwith is a star TV interrogator. He has a following, he does, as well as an ugly little pig of a research assistant, and . . . .

Who, if anyone, will Sopwith marry? Consider: Two centuries hence, the ugliest woman in the world, Hsia Shanyun, is caught in an attempt to blow up a chunk of the establishment with a striped hole she has plaited from superstrings. For punishment, she loses everything that makes her ugly—big tits, sleek, muscular limbs, even, white teeth, you know, all those atavistic

3. It is, in fact, so funny that I have the sneaking suspicion that that "peritonitis" blooper might have been deliberate.

items that once upon a time made our apish male ancestors stand up and drum upon their chests—and is exiled to a distant prison world. Years later, she escapes via another striped hole, but to our own time, where . . .

Just to complicate matters, add in a polymath astrologer who has identified a convergence of celestial influences that will make certain people able to perform such wonders as plucking striped holes from the interior of the sun. Toss in God Himself, in the person of George Bone.[4] Stir in such a heaping measure of snide, nose-thumbing comments on individual and social foibles that without it *Striped Holes* would make no more than a short story. And there you have it, the novel, a little thin perhaps, but fun.

The Knight and Knave of Swords is billed as the last installment in Fritz Leiber's saga of Fafhrd and the Gray Mouser. At least one part has appeared as a shorter tale in a magazine.

It's good, solid fantasy, but I wish it were better than it is. The two heroes are settling down on isolated Rime Isle, but magical foes remain after their hides and their wizard mentors, who want them back in Lankhmar, are enlisting the gods themselves to drive them home with the unique curse of the smalls (the Mouser must go about collecting bits of trivial debris from the gutters) and the stars (Fafhrd must ever keep his eyes on the skies), while other gods want them dead. Yet good fortune attends the Twain, and the curse itself lets them defeat assassins, while the bumblings of their friends aid in their defeat of Death himself and Death's own machinations provide clues essential to saving others. Events progress, children, lovers, and plots emerge from the past, and it seems very likely that "They lived happily ever after."

So what's the problem? I swear that Leiber's past tales, even his Lankhmar fantasies, have shown a leaner, cleaner prose. Now he has fallen ill with adjectives, even beyond the bounds of adjectivitis common to sword and sorcery fantasy. He has, in fact, become downright purple.

E. E. Horlak, writes Bantam's Lou Aronica, is really Sheri S. Tepper. From here on out, this is the name she will use to go with the "controlled, intense voice" she uses in such works as **Still Life**. She will use her own name when she uses "the broad, sweeping voice of *The Gate to Women's Country* and *After Long Silence*."

Still Life presents a young woman, Sarah, living at home with her mother, Ann, while she attends the local college. Her father died when she was young. Her grandmother was a Hopi Indian, and her grandfather was an Anglo who now runs a trading post in Hopi country. She herself has the hots for Martin, the man next door, and her mother seems interested in Martin's father, Arnold. Then, one day, there is a mysterious woman wandering the neighborhood. She is, she says, an artist, a painter of covers for horror novels, and she wants to paint Martin's house. They invite her to move in, she paints a spooky portrait of Arnold's wife, Olivia, and Olivia dies. Arnold marries the painter, more deaths follow, and more spooky paintings appear. Is the painter a witch?

Sarah is falling for her anthropology prof and goes with him on a Mayan field trip, until a black jaguar carries off two people in her near vicinity. They return home, where she learns ominous things

4. I wonder if Broderick was thinking of a certain comedian? See above.

about her little black pussy cat. They flee again, taking Martin's two kids with them to Sarah's Hopi kin, seeking the protection of Hopi magic.

And the painter dies. They can return home. But . . . you, dear reader, are only a little past the two-thirds point in the story. You know Sarah, her lover, and the kids cannot yet be safe. There are revelations to come, they are bound to surprise, and the path of true love just may not run smooth.

Sadly, I found the tale well told but not enough so to be convincing. Part of the problem is simply that I balk at magic. The bulk of the problem is that there are just too many intrusions of the "If we had but known" sort; they render the tale predictable, and it is already predictable enough for any reader who has encountered the basic formulae of horror before.

Christopher Stasheff has made an admirable cottage industry out of his interstellar civilization in which a group of psi-talented refugees founded a planetary culture—Gramarye—in which magic came to work. The first of the nine books in the series, starring Rod Gallowglass and his faithful robot companion and steed, Fess, were energetic, charming, and often funny. I loved them. More recent volumes have become tedious, the humor strained, the charm worn thin, the energy replaced by wheezes.

To prove my point, here is **The Warlock's Companion**. The basic story is so: Rod and family, on vacation, will examine a castle enfeoffed to them by the king. The castle reportedly has a ghost of supernal nastiness, and when they arrive, they find the reports are quite true. But they use their magical powers to embarrass the poor ghost dreadfully with pratfalls and ridicule, and he departs. End of story.

End of a *short* story, not near enough to make a book. Stasheff makes up the deficiency by interrupting the tale periodically to have Fess (the "companion" of the title) reminisce about his previous owners. The point is generally to teach Rod's kids something about their family history and to offer up a few cautionary tales about right living, but one of the reminiscences occurs entirely in Fess' brain and serves only to fill in a little background on Rod.

The end result is a very thin pretense of a novel. If enough of you pass it up, perhaps Stasheff will come up with something fresher.

Dreams of Gods and Men is the sequel to William T. Quick's *Dreams of Flesh and Sand*, which I praised. I therefore picked it up in full anticipation of enjoying my reading, and I wasn't disappointed. The only real problem is that Quick does take a while to bring the reader up to speed, and the problem is the worse because a number of important developments have taken place in the time between stories.

The first book introduced Berg (the "Iceberg") and his wife Calley, experts in software security who are called in to solve a little problem for the inventors of "meat" computers, based on human tissue cloned from the brain of one of the inventors. They succeed in a sense, but only by leaving said inventor loose in the dataspaces, half human, half something else, wholly alien, his capabilities crippled but still ominously potent.

Now we learn that this composite intelligence has become the flawed god Arius, served by genetically engineered berserkers as he strives to supplant humans entirely. Berg and his friends must somehow defeat Arius and his

schemes—and they cannot stop just because Berg is killed (what will Arius turn the body into?) and Calley is blinded by *something* lurking in the dataspaces. They must bring war to the priesthood hidden in the warrens beneath Chicago, seek out the nanotechnologists on the Moon, repair the blemished god, and in the end . . . Suffice it to say that the god remains within the machine, but now with company, and that at least one more entry in the series seems very likely.

Michael Kurland's **Perchance** is an entertaining tale of a civilization that roams across the parallel worlds of the Paraverse. Unfortunately, it also strikes me as a little too close to Keith Laumer's tales of the Imperium to be as enjoyable as it should be in its own right. And that's a shame, for Kurland tells a richer, more complex, more engaging tale, and he tells it better.

The parallel-world pattern is clear from the start, when a passenger dirigible delivers to New York young Delbit Quint, an intelligent, perceptive apprentice who has just been sold to a new master, the head of "The Faineworth Clinic for the Aid and Examination of the Bewildered." Delbit soon learns that he is to serve as a means of studying a mysterious woman with a tendency to disappear, leave her clothes behind, and reappear a few days later, in public and nude. Mysterious strangers appear, asking questions about the lady, now nicknamed Exxa, and threatening to destroy the city. Delbit contrives to follow Exxa into freedom. And then, after a suitably adventurous interval, we come to the Imperium.

Kurland's Imperium is called the Overline, but its agents, like Laumer's, travel from world to world in spaceship-like shuttles, fear competition from other lines, some of them nonhuman, and enrich themselves by cross-line trade. When they notice certain anomalies on a distant line, they investigate and find Delbit and Exxa and Exxa's talent for linejumping without the aid of a shuttle. In due time, Delbit looks to be solidly in line for training as an agent of the Imperium-cum-Overline and Exxa, now revealed as the princess of her dreams, as his future love. Together, in what seem the inevitable future volumes, they will battle evildoers and cover themselves with glory.

ANADEMS

FYI: I've just received my first copy of **Fantasy Commentator**, Vol. VI, No. 2, Fall 1988, $4.00 from A. Langley Searles, Editor & Publisher, 48 Highland Circle, Bronxville, NY 10708-5909. It's a nicely printed, fairly serious fanzine dedicated to looking at SF and fantasy from now back through the dim mists of time. This issue contains three poems (by Bruce Boston, Lee Becker, and Steve Sneyd), an interview with Raymond Z. Gallun by Eric Leif Davin, articles by Sam Moskowitz, E. F. Bleiler, and (a reprint from 1930) Algernon Blackwood, and reviews by Moskowitz, Searles,and H. R. Felgenhauer. If that sounds like your cup of tea, go for it. ■

●Ability is like a check; it has no value unless it is cashed.

ANON.
Submitted by John Hradsky

brass tacks

Dear Dr. Schmidt,

We are writing in response to John G. Cramer's *Alternate View* column of mid-December, "Dyson on Space." While many of Cramer/Dyson's points were well taken, the overall negative tone of the article regarding NASA leads to unjustified conclusions about the character and capability of NASA's people and management.

First, it is best to put things in perspective. There are simply too many good ideas out there to fund them all. This has contributed to division within the scientific and space community, particularly, as Cramer puts it, between the "get humans into space at whatever cost," and the "dump spaceflight and do space science with machines" camps. As not all ideas or projects can be funded to the levels each party would desire, there are many left feeling shortchanged and quick to place blame for funding woes on the success of others. Dyson's advocacy of a balanced manned/unmanned program with constructive scientific emphasis is a refreshing break from all this cross-negativism.

Unfortunately, Cramer (used loosely here, for it is difficult to distinguish between Cramer's and Dyson's views in the article) soon falls into a set of negativisms of his own. He begins by expressing regrets about "paths not taken" and describes an alternate Apollo Program of far more extensive and scientific lunar exploration: "The main thing that was lacking in Apollo for good science was *time*." Yet such a scenario, when juxtaposed with Apollo in the way it actually occurred, seems to imply that the way Apollo *was* carried out was wrong and bad. That because it was good PR and good politics, its overall character was fundamentally unclean and corrupt—a product of an evil, job protecting, and technocratic bureauc-

racy (the "B" word). Such pure negativism does nothing for our space program and nothing to help NASA get back on its feet. Indeed, it does the very opposite by undermining the fickle amounts of support our space program does receive.

The article reverts to the unfortunately all too common practice of "NASA-bashing." It would be unrealistic and unwise to hold NASA above all criticism—it is an imperfect agency composed of imperfect people from an imperfect society. We owe it to ourselves as a nation to strive for the best future possible. What we refer to as NASA-bashing does nothing of the sort. It is criticism which offers no solution. It is disappointing to find its occurrence in a science fiction magazine of as high repute as *Analog*, for the readers of science fiction have traditionally been among the strongest supporters of the space program. Indeed, just as the writings of Jules Verne inspired the likes of von Braun and Korolyev, many of today's young engineers and scientists have been inspired by Asimov, Clarke and the many talented writers contributing to *Analog*.

What then is the motivation of such negative bashings? In the general media it is perhaps just sensationalism by poorly informed reporters. However, in science fiction it is more likely out of good intentions, yet an expression of frustration. As mentioned earlier, there are simply far too many good ideas out there to all be achieved. No human endeavor seems ideal so long as there is dissent over priorities, which will always be the case to some extent.

NASA-bashing attributes to NASA characteristics that it does not have, and blames it for things it has not done. Yes, NASA is often too bureaucratic. So is Boeing. So is civilization in general. . . Any organization must ultimately stand on the people who comprise it. By and large, the people of NASA are competent, professional and dedicated.

What NASA has *not* done, yet often been accused of, is setting our nation's space policy. We are not yet at the point where we can fairly invoke Robert Heinlein's definition of a civil servant as a civil master. Indeed, if the engineers and managers at NASA could set our policy, we might very well be colonizing Mars at this very moment, *and* pursuing space science to the utmost. Such questions as "Will the agency continue to place science far down in the priority queue, going always (always?!?) for the premature choice and the job security of mammoth engineering projects?" are blatantly unjust to what NASA and its people represent.

Cramer discusses what Dyson terms "the Problem of Premature Choice" as if it were a deliberate NASA policy to be limited in its options and unable to pursue all promising programs. Has he not considered that such difficult management choices might be the unfortunate side effect of NASA's 75% budget cuts in the 1970s? So long as political and financial support for NASA remain as nebulous and erratic as in recent years, no amount of goal-setting or restructuring, will fully eradicate the difficult binds NASA managers currently face on a daily basis. Indeed, this political climate is most responsible for turning potentially wonderful projects into millstones around the neck of NASA.

Lastly we choose to address Dyson's views about NASA's current programs and future. ". . . the shuttle and the Space Station will, from the perspective of 30 years in the future, appear as quaint and misguided ventures in the wrong direction. . . . the successful

space activities of the future will bear little resemblance to NASA's present long range plans. Manned spaceflight will emphasize biology, learning how to grow crops and establish an ecological basis for permanent human settlement." If anything, this view very *closely* resembles some of NASA's long-range hopes.

Earlier, *time* was regarded as essential for better science on the Moon. This is *exactly* the purpose of Space Station—to allow time for much more detailed research in space, both for space science, and for space biomedicine. NASA supports ongoing research in Closed Ecological Life Support Systems (CELSS) with research currently being conducted at various U.S. institutions as well as in Japan and Europe. The Biological Research Project, including a 1.8 meter centrifuge for the Space Station will investigate the thresholds of biological sensitivity to gravity —greatly enhancing our physiological understanding of the space environment. A family of "Great Observatories," of which the Hubble Space Telescope will be the first, will see farther than ever before in the optical, x-ray, gamma, and infra-red regions, providing new answers (and even more questions) to the scientific community. Indeed, as Dyson predicts, space probes will be ever more sophisticated. A comparison between the Galileo Jupiter Spacecraft with its relatively high degree of onboard programming and Pioneers 10 and 11 which were essentially "flown from the ground" indicates this trend. Similar improvements can be expected for the future—as well as new technologies altogether. The point of all this is that the visions of Dyson, Cramer, and NASA have much more in common than previously assumed. Our goals are largely the same and we should work in support of each other, not tear each other down.

In closing it seems fit to remind people of some of the positive achievements of the space program. NASA has sent working robots to the outer planets and out of the Solar System. Soon, construction will begin on the world's first real space station—the next step towards man's permanent use of space. These people have been a source of pride and vision for America. They turn dreams into reality and the future into the present. They are working for a better tomorrow.

They deserve our support and pride.

PAUL A. CARTER

BRUCE D. CARTER

Tucson, AZ

Dear Mr. Schmidt:

This is Wednesday . . . received my Mid-December *Analog* Monday . . . Brought home work last two days, so tonight am scarfing down contents of 'zine (nice change from work!) and have come up with a datum that requires an answer that I don't have. Briefly: what are the odds against or in favor of three stories, by three different authors, appearing in the same issue of *Analog* and having protagonists by the same name? I refer to:

"Social Contract," by W.T. Quick

"Gravesite Revisited," by Elizabeth Moon

"Space Opera," by Charles Sheffield

While I'm using a 25¢ stamp, might as well say that, in my opinion, "Guz's Place" is the best novelette of 1988.

Oh, yeah. The protagonists' name, by the way, is Carver. . . . I s'pose in "Gravesite" the name comes from his occupation?

MAYDENE CROSBY

Lafayette, IN

Pretty long odds, but all those Carvers were just coincidence. The problem: stories get typeset long before they get assigned to an issue—and by then it's too late to change names! (Besides, real life is full of such coincidences. I once taught a class of nine students—five of whom were named "Bob.")

Dear Mr. Schmidt:

I just finished reading "Guz's Place" in your mid-December issue and was astonished to find Anthony Boucher's work being used without any credit or reference to it. I believe that Mr. Boucher published a story called "Q.U.R." in *Astounding Stories* some 40 or 50 years ago. In that story he created a drink called Three Planets, which contained margil, vuzd and rum. In the story the drink is mixed by someone named Guzub. Imagine my astonishment to find all of that present in "Guz's Place." Even the word "Varginian" is used, although not to describe the same thing.

While I understand that using someone else's work may be a way of paying tribute to them, it seems to me that it has to be done in such a way that every reader knows it.

DAVID WEIDENFELD

Buffalo Grove, IL

The authors reply. . . .

Dear Mr. Weidenfeld,

Dr. Stanley Schmidt, editor of *Analog*, sent us a copy of your letter to him about our story, "Guz's Place."

First, many thanks for your careful and attentive reading—and, yes, you are right: we *did* borrow several personal and place names from Anthony Boucher's "Q.U.R."

We feel, and hope that you agree, that the borrowings were incidental to the main plot, and, at one level, are just a private tribute to one of the classic writers in SF. But maybe there is another level, too.

Somewhere in the background of the way the story was written was the idea that perhaps—just barely perhaps—this world (the one we all live in, and call "real") actually is inhabited by all the characters of human fantasy. Maybe there is a real Guzub, a real Oz, a real Looking-Glass World, and we, caught up in our daily tedious affairs, just don't see it. Or, when we do, it's out of the corner of our eye, as if we were riding a bus and, upon glancing out the window, saw a sign that announced "Tours of the Solar System. Special Payment Plan Available."

The mysterious, adventurous, fantastic admixed with the trivial and the banal. So a little neighborhood restaurant opens up—but it isn't quite what it seems. Instead, there is— who knows? —perhaps a cousin of Old Guzub, the Varjinian rebel . . .

Dr. Schmidt has an editorial position that he expresses nicely: an SF story should stand on its own. It's a good idea, too, even if he turned down a short piece of ours based on Martin Gardner's "Thang." And, with all due respect to his experience, yet, still, maybe the world we call "real" does have strange restaurants with Martian proprietors, or maybe they're not Martian either.

Second, you pointed out that we should have credited Boucher for the borrowing. You are probably right, though we did not think to do so. However, let us take this opportunity to make our indebtedness to his work clear, and it is a pleasure to say so.

Once again, thanks for your careful reading, and your interest in writing to Dr. Schmidt.

TIMOTHY PERPER & MARTHA CORNOG

To the Editors:

Regarding the earliest SF mention of

room-temperature superconductors (Brass Tacks, January 1989), consider *Gray Lensman* by E.E. Smith, copyright 1951. In chapter four, we get a description of Patrol technology in the *Dauntless*, whose bus-bars were "laminated members built up of co-axial tubing of pure silver to a diameter of over a yard . . ." to transport the millions of amperes required—an example of carrying 1940s technology to extremes. There followed descriptions of the difficulty in switching such currents, and the gargantuan scale of the Patrol equipment required. Then, in a defense installation on the planet Medon, Kennison expects to see "bus-bars ten feet thick, perhaps cooled in liquid helium . . ." Instead, he finds "the whole output is going out on two wires no bigger than number four . . ." There followed discussion of Medonian perfect insulators and switching technology. In chapter eight, the Patrol is "rebuilding our first-line ships, super-powering them with Medonian insulators and conductors. . . ." In chapter twenty-three, there is a reference to "Q-type helices, driven with all of the frightful kilowattage possible to Medonian conductors and insulation. . . ."

Clearly, Smith is speculating on conducting technology far in excess of the time. I don't believe the reference to liquid helium refers to the specific phenomenon of low temperature superconductivity, but simply to a need for massive cooling. On the other hand, the Medonian conductors were both room temperature and certainly "SUPER!"

BILL HOLLIFIELD

15 Tally Ho Trail
Belle Mead, NJ 08502

Dear Dr. Schmidt:

Having read your editorial giving the reasons for your present preference for the novelette as opposed to the serial format in *Analog*, I beg to disagree. You are simply not taking both the reader and his pocketbook into account.

Though I am 62 years of age and have retired as a research chemist a year ago, I still find my time limited in respect to reading, and the prices of SF books that are "hot off the press," prohibitive.

I could belong to a book club but have found that I tend to purchase and fill my limited shelf space too often. I subscribe to *Analog*, *Asimov's*, and *Amazing*, your magazine is by far the best, perhaps this is mainly due to the serials. The serials tend towards the less cerebral and are more action-oriented, which I became addicted to more than 50 years ago.

Your companion magazines also tend to devote too many valuable pages to non-literary nonsense, which of course I pay for and they do not.

I do buy novels when their price has dropped and often because I have first been exposed to the story in *Analog*. Because of this, I cannot be that selective, and am dependent on overproduction.

The short story, by the way, appears to be a lost art and too many have reverted to formula and/or terminal cuteness.

I remain a subscriber but still look forward to the serial.

HERBERT BLOCK

Brooklyn, NY

Don't worry: I have no intention of doing away with serials altogether, and I don't even have a categorical "preference" for shorter lengths. The editorial was just to explain why, when I have to choose between serials and shsorter pieces, the criteria are not the same as they used to be. That will probably lead to somewhat fewer novels and

more shorter pieces, but one is certainly not going to squeeze out the other.

Dear Mr. Schmidt:

I enjoy your editorials. The subjects are almost always topical, and to my eye, are splendidly crafted to stimulate the readers' thought processes, or, in some readers, cause the mental spigot to open on well developed, and fiercely held, biases. By and large, however, I find the editorials, and the many reasoned responses that appear in "Brass Tacks," the best parts of your magazine. With that said, I will open my spigot for a paragraph or two on the editorial in the February, 1989 issue, "Internal Affairs."

A discussion of the concept of a "world government" is a sure fire exercise in frustration, mostly because the "us" and "them" dichotomy you describe in your editorial gets the blood pressure so high in everybody within earshot that logic and reason become the immediate casualties, and the discussion breaks down into an argument of bias and ignorance, rather than a discussion where ideas are exchanged.

Let me present a parable to demonstrate the matter. Suppose that in a fictitious barnyard the animals think they are having a problem getting the right feed, and that the habits of some of the animals are offensive to some of the others.

Concerning food: the cows wants hay and fresh grass, the chickens want corn and grain, the sheep want silage, the pigs are neutral because they will eat anything. In regard to those animals with bad habits: the cows are berated because they never watch where they put their feet, and physically endanger the smaller animals; the sheep eat the grass down to the roots so nothing will grow, and the dust from the bare ground gets in everybody's eyes; the pigs make such a mess with their wallows that they are considered a menace, and so on. After days of argument the animals cannot decide on what food should be bought or how it should be divided up.

The only opinion that is not solicited in this syllogism is that of Farmer Jones, and he is not invited into the conversation because he "does not understand" the animal's point of view or their problems; he is not one of the animals (us), he is one of "them." The real problem in this contrived tale is that the animals do not recognize who the real decision-making power is in the barnyard—Farmer Jones! In this system it makes no difference what the animals think, or even what they decide, if they ever can decide. Farmer Jones will decide on the kind of feed to buy, who will use what area of the barnyard, and will impose whatever discipline or rules of behavior he considers appropriate and necessary. He will also decide who goes to market.

In many respects, a well-intentioned, and highly intellectual discussion of the rightness or wrongness of the social/political practices of some sovereign entity; or what should be done about world famine; or should the Brazilians be made to stop cutting down their tropical rain forests, and so on, plays very much like the barnyard animal debate for no other reason than the discussion most often completely fails to recognize who is doing what to whom in this world. As a generalization, what will happen (e.g., national sovereignties acting as economic entities, multinational corporations, banking conglomerates), and not by the people, despite the much ballyhooed, and badly overrated, "world public opinion."

The concept of some sort of world government seems to get its biggest

boost from parts of the intelligentsia and, strangely, the academic community. The strongest talk of creating a great and wise super government most often comes in good economic times when the dangers of widespread starvation and chaos are not particularly evident. The thought of an omnipotent power acting in the best interests of the population of all the world, benevolently driving off hunger and want, seems to have a paralyzing effect on the rational thought processes of some usually very smart people. Somehow, it is thought, hunger here or a crop failure there can be set right through the utterly simple process of redistributing little packages of food, or sending agricultural surpluses (or the surpulses of anything) to the places in need. In the real world the various economic systems that actually control events mark such simplistic thoughts as absurd.

Problems that seem to be of the right magnitude and threat to be treated, literally, as world-class problems, as I view it, are not generally reducible through the application of the right amount of sympathetic thinking or the right computer distribution network program. In fact they might not be resolvable at all!

When the subject of establishing a world entity to solve "world problems" crops up, there is a flag that starts to wave in my mind that reminds me that unless it is agreed at the outset that absolute world economic, social and spiritual powers are principle requisites for a "super solver," what follows is reduced to only a discussion of how the transfer of power is to be accomplished (which usually begins with a detailed argument of the meaning of the phrase "fat chance"). If the stipulation regarding the transfer of power is not made, then I generally try to change the subject to an analysis of the operating parameters of a trans-light starship drive, as the next most productive subject for discussison.

TOM DAVIS

Chula Vista, CA

Dear Mr. Schmidt,

In *re* your Feb., 1989 editorial, you will doubtless receive a mountain of letters from people of all moral and political persuasions castigating or praising you depending on their particular beliefs. I, for one, am happy to see the issue raised. Like mom, the flag, and apple pie, "human rights" has become an issue that everyone dances around very carefully.

People with any kind of memory at all will recall that "human rights" was not a serious concern to the general public until Jimmy Carter, looking for a cost-free way to flaunt his and the U.S.'s moral superiority, made it one back in the '70s. It was an ideal vehicle for his preachy southern baptist style and, more importantly, didn't require him to do anything or spend any money.

Although various religious types will contest this statement, it is vital that we understand that there are no absolute rights in this world. The Declaration of Independance notwithstanding, rights are only what a given society agree they should be—no more, no less. We do not have the God-given right to impose our values on others no matter how desirable we believe them to be.

With very few exceptions, relationships between nation/societies should be based on the willingness of both sides to honor mutually agreed-upon international obligations or bilateral treaties. How people govern themselves internally should never (except in the most extreme circumstances) enter the equa-

tion. This "realpolitik" is not new but it certainly is out of favor today.

You may ask, "What are 'extreme circumstances?' " OK. The Khmer Rouge massacre in Cambodia, Germany's extermination of the Jews, Stalin's starving of the kulaks should qualify as sufficiently horrific. South Africa's suppressison of the blacks or Israel's suppression of the Palestinians should not.

I am neither a "one worlder" nor an isolationist. What I am saying is: let's get off everyone's case, get our economic house in order, maintain a stout defense, offer help when asked but, otherwise, stop mucking around in others' lives.

JACK PAYE

7107 Buckingham Dr.
Germantown, TN 38138 ■

Mary Caraker

THE INNOCENTS

Translation has never been easy—and with aliens, the subtleties may do you in!

"What incredible luck," SEF colonial director Jamison crowed. He angled his gravchair to allow him to lean backwards while he surveyed the cloud-streaked, blue and green sphere that filled half the viewscreen. "We'll make millions on immigration permits alone, not to mention the lumber and mining rights. It's a gold mine!"

"Yes, it's a find, in every way," agreed Captain Lorq of Space Exploratory Force's military division. "A perfect location for our base in this sector." He frowned slightly. "I only hope, though, that the natives are as amenable as you seem to think. Just because they've asked for teachers . . . and are you sure that's what they actually said?"

"There couldn't be any mistake," Jamison assured him. "The contact team used the voder, and it had no difficulty translating their speech. They want teachers, all right." He folded his hands on his round stomach and smiled complacently. "Trust me—they're practically handing us the planet."

"How do you figure that?"

Jamison tilted his chair back upright. "You know the contact rules. No contamination of an alien culture. We aren't allowed to tell them anything unless they specifically ask. Hell, the bleeding-heart xenologists have got us so tied up it's a wonder we ever find a world we can use." He stabbed with his finger at the display on the screen. "These monkey-men, though, they're trusting as babies. The contact team said they're eager to know all about us. The 'teachers' I'm sending won't have any restrictions from the xenos, and they're primed with what *I* want them to say." He grinned. " 'We good guys. We give you nice presents, you let us have land you don't want.' " He leaned back again. "So, does that answer your question?"

The captain returned the grin. "I'll get started right away with plans for the base."

One Droop Eye stooped as he stepped through the low doorway of the mud and wattle hut. His friend Plumed Tail, reclining on a rush mat, looked up sleepily. "What brings you abroad so early? Don't tell me the furless teachers have already arrived!"

"No, not yet," One Droop replied. "But everything is ready for them.

Don't you want to come watch with the others?''

Plumed Tail's eye antennae wobbled as he yawned. ''I suppose so, now that you've awakened me.'' He groomed himself hurriedly and selected a loin strap of woven sastrax tendrils. ''I still can't believe our good fortune. Are you sure about what the talking box said?''

''Yes, absolutely. They *want* to send us teachers. Just think—what wonders they must know! And to be so willing to share with us! We can never do them enough honor, but we must try. Sweetness and her food teams have prepared a welcoming feast, and I thought we might stop by and see what they have ready.''

The two males found Sweetness surveying the heaping bowls arranged on broad leaves spread over the grass. Float flowers provided a shady canopy, and a row of laughing children with fans stood insect watch. ''It looks perfect, as usual,'' Plumed Tail said. ''Our guests should be well pleased.''

''I don't know,'' Sweetness said worriedly. ''The sauce for the lupods didn't turn out quite right. Do you think I have time to run and ask what I did wrong?''

One Droop stared up at the sky. ''Yes, you have time—I see no sign of the skywagon yet.''

''Then watch the children while I go,'' Sweetness said. ''With such important visitors, who are about to give us so much, it would be embarrassing if everything were not not up to standard.''

The males assented, and Sweetness hurried through the village clearing into the surrounding grove. She shinnied up the trunk of a spreading muscale tree, settled herself in its crotch and spoke her question.

The leaves above her rustled.

''Yes, the strangers are amazingly noble,'' Sweetness agreed. ''You see why it would be an insult to offer them even such a small disappointment as an inferior sauce. I thought I remembered all the ingredients, but something must be missing.''

A branch above her dipped, suspending a ripe, spiny-skinned fruit within easy reach. Sweetness picked and peeled it and chewed it reflectively.

As she ate, her face brightened. ''Ah, the dried sassagrass. How could I have forgotten!'' She stroked the bark of the muscale's central trunk, murmuring gently. ''Thank you, Teacher One Stripe. If the furless ones provide us with half as much wisdom, the tribe will be fortunate indeed.''

On her way back to the compound, Sweetness spoke greetings to Teacher Broken Tooth and spread wetmoss around small, recently planted Teacher Scar. Next to Scar the new burial pits yawned black and hungry, with the selected saplings waiting beside them. ''Yes, such generous creatures,'' Sweetness marveled again. ''To offer themselves so freely, and before their years have even been completed.''

''Sure, go ahead and draw up your plans,'' Jamison said to the captain. ''My 'teachers' have just left. It'll be like taking candy from a baby.'' ■

a calendar of analog upcoming events

28-30 July
RIVERCON 14 (Louisville area SF conference) at Louisville, Ky. Registration—$15 until 15 July, $20 at the door. Info: Rivercon 14, Box 58009, Louisville KY 40258.

28-31 July
MYTHCON XX (Mythopoeic conference) at University of British Columbia, Vancouver, B.C. Guest of Honour—Guy Gavriel Kay, Scholar Guest of Honour—Raymond Thompson, Registration C$25, Room & board C$125. Info: Mythcon XX, Box 806, Station A, Nanaimo BC V9R 5N2 CANADA.

4-6 August
CONN-MINI-CON (Connecticut SF conference) at the Quality Inn of Bristol, Bristol, Conn. Info: ConnMiniCon '89, 63 Magnolia Avenue, Bristol CT 06010. Include S.A.S.E.

4-6 August
INTERCON 89/NORCON 8 (Norwegian SF convention) at Oslo, Norway. American Guest of Honor—Samuel R. Delany, Norwegian Guest of Honor—Tor Age Bringsvaerd. Registration—$18 (or £10). Info: Heidi Lyshol, Maridalsvn. 235 A, N-0467 Oslo, Norway.

10-13 August
GENCON '89 (gaming convention) at Mecca Convention Center, Milwaukee, Wisc. Registration $40 at the door. Info: GenCon '89 Game Fair Headquarters, Box 756, Lake Geneva WI 53147. (414)248-3625.

12-13 August
Houston Fanfair (media-and sales-oriented convention). Registration—$6 at the door; attendance estimated at 600-800. Info: Bulldog Productions, Box 820488, Dallas TX 75382. (214)349-3367.

28 August-1 September
11th World Computer Congress '89 (IEEE) at San Francisco, Calif. Info: Stephen Yau, Chairman, Organizing Committee, University of Florida, CIS Department, Room 301, Gainsville FL 32611. (904)335-8006.

31 August-4 September
NOREASCON 111 (47th World Science Fiction Convention) at Sheraton-Boston Hotel and Hynes Convention Center, Boston, Mass. Guests of Honor—Andre Norton, Ian & Betty Ballantine; Fan Guest of Honor—The Stranger Club (Boston's first SF club). Registration—$80 (adult), $50 (child) until 15 July. Supporting—$20 at all times. No advance memberships after 15 July 1989. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Info: Noreascon III, Box 46, MIT Branch, Cambridge MA 02139 or 76107,270

8-9 September
Austin Fanfair (media- and sales-oriented convention). Registration—$6 at the door; attendance estimated at 600-800. Info. Bulldog Productions, Box 820488, Dallas TX 75382. (214)349-3367.

—Anthony Lewis

Items for the Calendar should be sent to the Editorial Offices six months in advance of the event.

Note: although not all conventions request it, as a matter of courtesy, you may wish to include a self-addressed, stamped envelope with your request for information.

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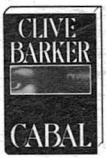

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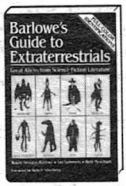

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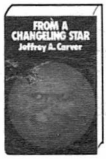

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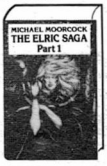

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