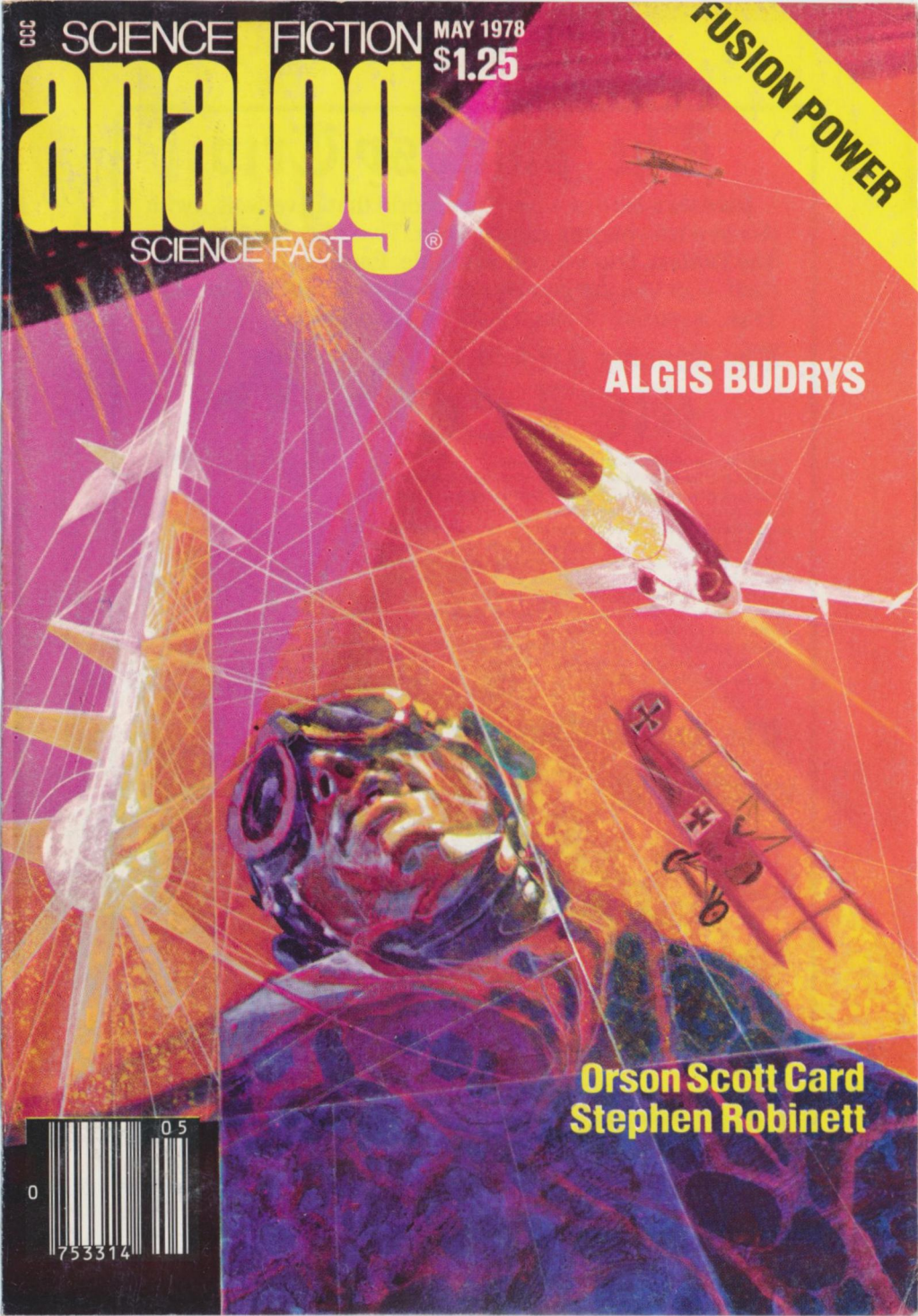
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The Fantasy Trip

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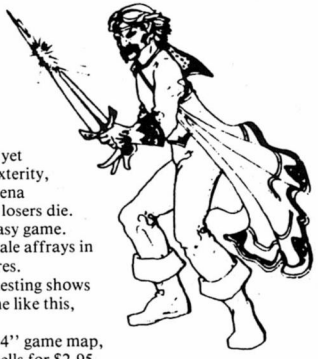
The Fantasy Trip: MELEE



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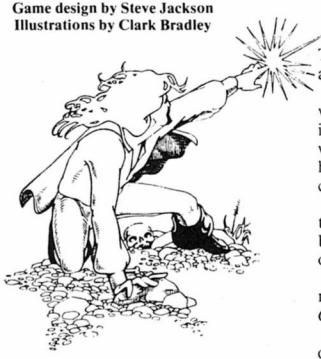
Game design by Steve Jackson
Illustrations by Liz Danforth

The Fantasy Trip: WIZARD

Game design by Steve Jackson
Illustrations by Clark Bradley



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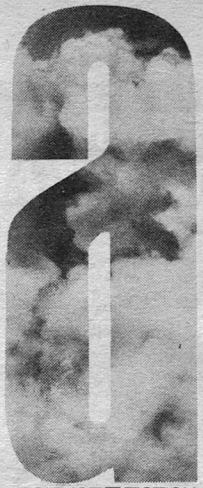

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CONTENTS

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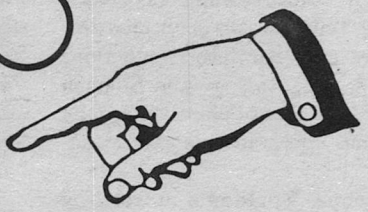


We managed to squeeze into last month's issue the results of our first-ever Annual Analytical Laboratory poll. For those of you who might have missed it, the winners were:

Serials

1. *After the Festival*, George R. R. Martin
2. *The Wonderful Secret*, Keith Laumer
3. *Of Future Fears*, Mack Reynolds

Novelettes

1. "Stardance," Spider and Jeanne Robinson
2. "Ender's Game," Orson Scott Card
3. "Pinocchio," Stanley Schmidt
4. "Stepson to Creation," Jack Williamson
5. "Beachhead," Dean McLaughlin

Short Stories

1. "A Time to Live," Joe Haldeman
   "A Rain of Pebbles," Stephen Leigh (tie)
2. "Lord of All It Surveys," Alison Tellure
3. "Dog Day Evening," Spider Robinson
4. "Skysinger," Alison Tellure
5. "Lauralyn," Randall Garrett
   "The Screwfly Solution," Raccoona Sheldon (tie)

It's an interesting tabulation of winners, with enough surprises to balance out the expected victories of some of our regular contributors.

Veterans such as Jack Williamson were joined by utter newcomers such as Orson Scott Card, whose very first published story, "Ender's Game," earned him a high ranking among the novelettes. The "old pros" showed well—Keith Laumer, Mack Reynolds, Stanley Schmidt, Dean McLaughlin, Williamson, and Randall Garrett. So did some of the "new pros," writers who were virtually unknown a few years ago, but who have become mainstays of Analog and of the science fiction field in general—George R. R.

Martin, Joe Haldeman, Spider Robinson.

Spider and Alison Tellure scored double victories, a powerful testament to their popularity. Spider's "Stardance" received more mail during the course of 1977 than any story we ran (although "Ender's Game" ran a close second). Tellure's two connected stories were only her second and third appearances in Analog. And Stephen Leigh's "A Rain of Pebbles" was only his second appearance in this magazine.

Raccoona Sheldon's unsettling "The Screwfly Solution" was the first story she had ever published in Analog. But, unknown to most of our readers as they voted, Ms. Sheldon (her proper first name is Alice) has been writing award-winning SF stories for years under the *nom de plume* of James Tiptree, Jr. Quality rises to the top, regardless of the byline!

There were no foregone conclusions in the voting. Each spot in each category was hotly contested; so hotly, that we had two ties in the short-story category—where the competition was fiercest because of the huge number of entries.

It's no surprise that writers such as Martin, Robinson, and Haldeman scored first in their respective categories. But the rather unexpected appearance of so many new writers among the finalists shows that Analog's voters judge *by the story content*, and not by the author's name or previous kudos.

Is there a common denominator among these winning stories? *After the Festival* was a dark, moody novel of characterization and emotion. "Stardance" was frankly sentimental . . . and hard-bitten at the same time. "A Time to Live" was a typical Haldeman short story, understated, strong, with a bitter tang to it. The other stories varied in mood and subject from Mack Reynolds's near-future *Of Future Fears* to Spider Robinson's talking-dog tale, from the poignant "Pinocchio" to the romantic "Lauralyn."

If there is a common denominator that the AnLab votes disclosed it is this: *content*. Analog's readers demand stories that have meat on their bones—strong characters, new and surprising situations, powerful problems that can only be solved by the interplay of human intellect *and* emotion. Not gadget stories. Not superhuman heroes who conquer galaxies without even perspiring. Not snivelers who throw up their hands and wail in despair.

Strong men and women who face strong problems and strive to solve them. That's the common denominator of Analog's stories.

Three of our winning authors were women. But Alison Tellure's stories could hardly be characterized as "feminist." On the other hand, Randall Garrett and George R. R. Martin seemed to stir more admiration for their female characters than most male writers did. And, of course, the tragic ballerina of "Stardance" stemmed more than a little from

Jeanne Robinson's personal experiences as a ballet dancer and teacher.

"Stardance," incidentally, is not finished. The Robinsons are working on a sequel to the original story, and eventually will have a full-sized novel that will be published separately. We plan to run the sequel(s) in Analog before book publication.

The Wonderful Secret is also part of a novel, *The Ultimax Man*, which is now available in bookstores. We were only able to publish the first third of Keith Laumer's novel, because of scheduling conflicts. So those of you who correctly pointed out that the serial left you wanting more, go out and buy the book!

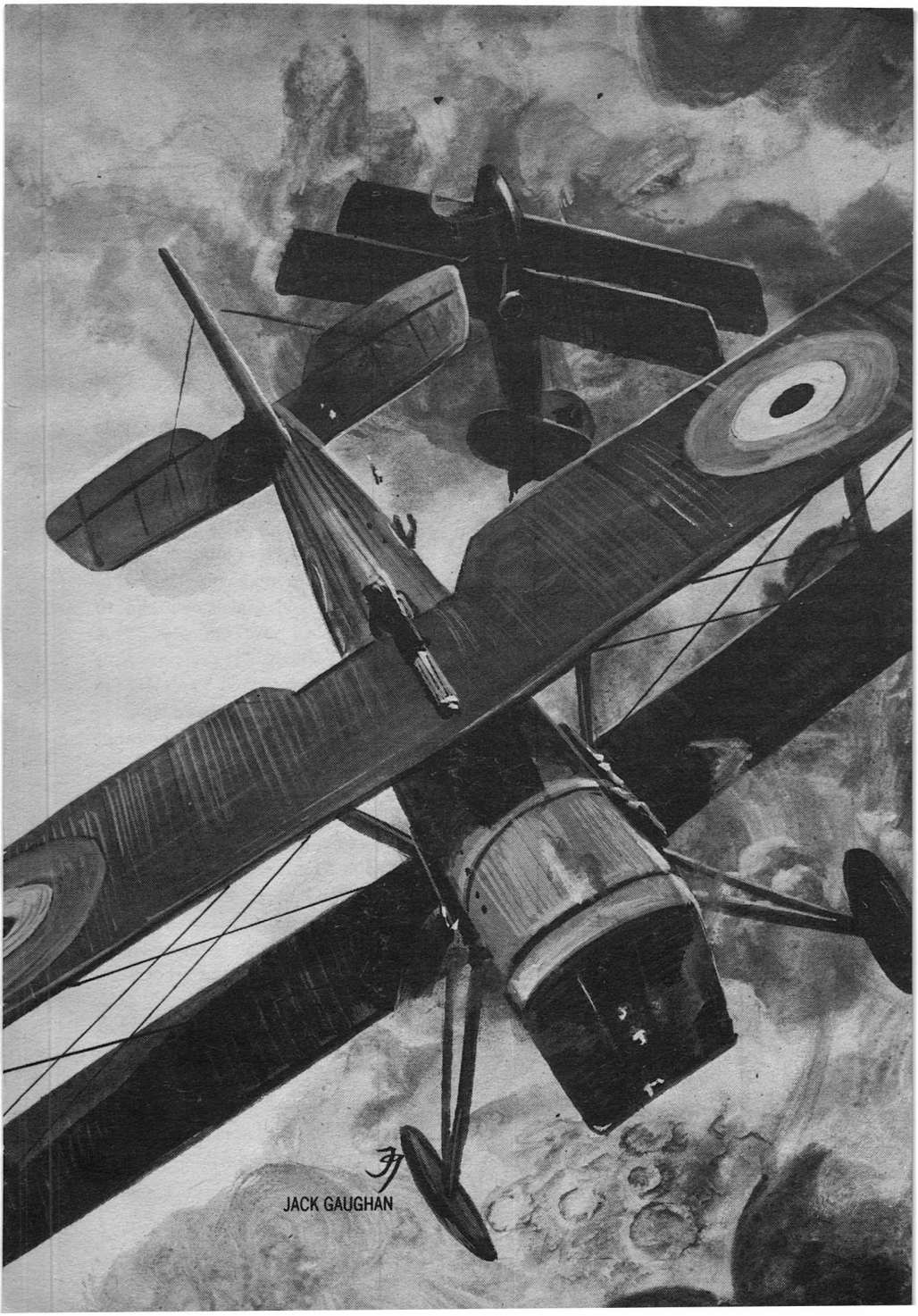
Several "Schuster" stories by Sam Nicholson *almost* made the final list, and many voters commented that they would like to see the stories put together into a book. Your wishes will be granted: *Captain Empirical*, Sam Nicholson's first novel, will tell Schuster's whole story—including much that has never been published in the magazine. It will be an Analog Book this autumn.

Finally, we still had the problem of a low voter turnout. Only about one-half of one percent of our buyers bothered to cast ballots. While that's statistically significant, according to professional poll-takers, it is barely so. You all enjoy reading the Analytical Laboratory ratings, *so why don't you vote?*

Wait 'til next year!

THE EDITOR


the nuptial
Flight
of warbirds
"The medium is the message" is equivalent to saying that the form is the content.
Algis Budrys


JACK GAUGHAN

The woman gasped slightly as he began to see her. Dusty Haverman smiled comfortably, extending his lean arm in its brocaded scarlet sleeve, white lace frothing at his wrist. He tilted the decanter over the crystal stem glass shimmering in the stainless air of the afternoon, and rosy clarity swirled within the fragile bell. "You'll enjoy that," he said to her. "It doesn't ordinarily travel well."

She was very pale, with dark made-up eyes and lips drawn a startling red. A lavender print scarf was bound around her neck-length smoke-black hair, and she wore a lavender voile dress with a full calf-length skirt and a bellboy collar. Below the collar, the front of the dress was open to the waist in a loose slit.

She sat straight in her chair. Her plum-colored nails gripped the ends of the decoratively carved wooden arms. The breeze, whispering over the coarse grass that grew in odd-shaped meadows between the lengths of sandy concrete, stirred her hair. She looked around her at the sideboard, the silver chafing dishes of hot hors d'oeuvres, the Fragonard and the large Boucher hung on ornate wooden racks, the distant structures and the marker lights thrusting up here and there from the edges of the grass. She watched Haverman carefully as he sank back into his own chair, crossed his knees, and raised his own glass. "To our close acquaintanceship," he was saying in his slightly husky voice, a distinguished-looking man with slightly waving silver hair worn a little long over the tops of the ears, and a thinish, carefully trimmed silver moustache hovering at the rim of the rose cordial. He wore a white silk ascot.

The woman, who had only a very few signs of latter twentyishness about the skin of her face and the carriage of her body, raised one sooty eyebrow. "Where are we?" she asked. "Who are you?"

Haverman smiled. "We are at the juncture of runways 28 Left and 42 Right at O'Hare International Airport. My name is Austin Gelvarry."

The woman looked around again, more quickly. Her silk-clad knee bumped the low mahogany table between them, and Haverman had to reach deftly to save her glass. She settled back slowly. "It certainly isn't Cannes," she agreed. She reached for the wine, keeping one hand spread-fingered over the front of her bosom as she leaned. Her eyes did not leave Haverman's face. "How did you do this?"

Gelvarry smiled. "How could I not do it, Miss Montez? Ah, ah, no, don't do that! Don't press so hard against your mouth. *Sip*, Miss Montez, please! Withdraw the glass a slight distance. Now draw the upper lip together just a suggestion, and *delicately* impress its undercurve upon the swell of the edging. Sip, Miss Montez. As if at a blossom, my dear. As if at a chalice." He smiled. "You will get to like me. I was in the Royal Flying Corps, you know."

Just at first light, the mechanics would have the early patrol craft lined up on the cinders beside the scarred turf of the runway. They would waken Gelvarry with the sound of the propellers being pulled through. He would lie-up in his cot, his eyes very wide in the dim, listening to the *whup, whup, whup*!

The mechanics ran in three-man teams, one team for each of the three planes in the flight. One would be just letting go the lower tip of the wooden airscrew and jumping a little sideward to turn and double back. One would be doubling back, arms pumping for balance, head cocked to watch the third man, who would be just jumping into the air, arms out, hands slightly cupped to catch the tip of the upper blade as it started down.

They ran in perfect rhythm, and they would do this a dozen times before they attempted to start the aircraft. They said it was necessary to do this with the Trompe L'Oiel engine, which was a French design.

Sergeant-Major MacBanion had instituted this drill. If it were not performed precisely, the cylinder walls would not be evenly lubricated when the engines were started. The cylinder walls would score, and very likely seize-up a piston, and all you fine young gentlemen would be dropping your arses, beg pardon (with a wink) all over the perishing map of bleeding Belgium. Then he knocked the dottle out of his pipe, scratched the side of the little gray monkey he liked to carry, and turned his shaved neck to shout something to an Other Rank.

Sar'n-Major Mac's speaking voice was sharp and confident, and his manner assertive, in dealing with matters of management. In speaking to Gelvarry and the other flying personnel, however, he was more avuncular, and it seemed to Gelvarry that he saw more than he sometimes let on.

Gelvarry, who was hoping for assignment soon to the high squadron, reckoned that Sergeant-Major MacBanion might have more to do with that than his rank augured for. Nominally, he was only in charge of instruction for transitioning to high squadron aircraft, but since Major Harding never emerged from his hut, it was difficult to believe he was not dependent on Sergeant-Major MacBanion for personnel recommendations.

Gelvarry swung his legs over the side of the cot, taking an involuntary breath of the Nissen hut's interior. Gelvarry's feet had frosted a bit on a long flight the previous week and were quite tender. He limped across the hut, arranging his clothes, and went over to the wash stand.

Gelvarry felt there was no better high squadron candidate in the area at the present time. Barton Fisher of XIV Recon Wing had more flight time, but everyone knew Armed Chase flew harder, and Gelvarry had been in Armed Chase for the past year, now being definitely senior man at this aerodrome and senior flying personnel in the entire MC Armed Chase Wing. "I should like very much to apply for assignment to the high

squadron, Sir," he rehearsed as he brushed his teeth. But since he had no idea what Major Harding looked like, the face in the mottled fragment of pier glass facing him remained entirely his own.

He spat into the waste bucket and peered at the results. His gums were evidently still bleeding freely. Squinting into the mirror, he lathered his face cold and began shaving with a razor that had been most indifferently honed by Parkins, the batman Gelvarry shared with the remainder of his flight in the low squadron. Parkins had been reduced from Engine Artificer by Sar'n-Major Mac, and quite right. "Give 'im a drum of oil and a stolen typewriter," Gelvarry grumbled as he scraped at the gingery stubble on his pale cheeks. "He'll jump his bicycle and flog 'em in the village for a litre of Vouvray."

He rubbed his face with a damp gray towel full of threads and bent to stare out the end window. The weather was expectable; mist just rising, still snagged a little in the tops of the poplars; eastern sky giving some promise of rose; and the windsock pointing mendaciously inward. By the time they'd completed their sweep, low on petrol and ready for luncheon and a heartfelt sigh, it would have shifted straight toward Hunland and God help the poor sod who attempted the feat of gliding home on an engine stopped by fuel shortage or, better yet, enemy action also involving injury to flying personnel. All up then, my lad, and into the *Lagerkorps* at the point of some *gefreiter's* bayonet, to spend the remainder of the war laying railroad lines or embanking canals, *Gott Mit Uns* and *Hock der Fuehrer*! for the Thousand Year Empire, God grant it mischief.

In fact, Gelvarry thought, going out of the hut and running along the duckboards with his shoulders hunched and his hands in his pockets, the only good thing about the day to this point was that his headache was nowhere near as bad as it deserved to be. Perhaps there was truth in the rumor that Issue mess brandy had resumed being shipped from England. It had lately been purchased direct under plausible labels from blue-chinned peasant gentlemen who cut prices in deference to the bravery of their gallant allies.

"Get out of my way, you creature," he puffed to Islingden, John Peter, Flying Officer, otherwise third Duke of Landsdowne, who was standing on the boards with a folded *Gazette* under his arm, studying the sky. "If you're done in there, show some consideration." They danced around each other, arms out for balance, "Nigger Jack" Islingden clutching the *Gazette* like a baton, his large teeth flashing whitely against his olive-hued Landsdowne complexion, introduced via a Spanish countess by the first Duke, neither of them wishing to step off the slats into the spring mud, their boot-toes clattering, until Gelvarry at last gained entrance to the officers' latrine.

The dampness rising from the

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ground was all through his bones. Gelvarry shivered without cease as he sprinted along the cinder track toward his SE-5, beating his arms across his chest. He paused just long enough to scribble a receipt for the aircraft and return the clipboard to the Chief Fitter, found the reinforced plate at the root of the lower plane, stepped up on it and dropped into the cockpit, his hands smearing the droplets of dew on the leather edging of the rim. He felt himself shaking thoroughly now, proceeding with the business of handsignaling the other two pilots—Landsdowne and a sergeant pilot named O'Sullivan—and ensuring they were ready. He signaled Chocks Out, and the ground personnel yanked sharply at the lines, clearing his wheels and dropping flat to let his lower planes pass over.

As soon as he jazzed the throttle to smooth his plugs and build takeoff power, a cascade of water blew back into his face from the top of the mainplane, and he stopped shivering. He glanced left and right, raised his arm, flung his hand forward, and advanced the throttle. The trim little Bristol, responsive as a filly, leapt forward. For a few moments, she sprang and rebounded to every inequality of the turf, while her flying wires sang into harmony with the increasing vibration of the engine and airscrew. The droplets on the doped fabric turned instantly into streaks over the smoke-colored oil smears from the engine. Then there was suddenly the smooth buzzing under his feet of the wheels rotating freely on their axles, all weight off, and the SE-5 climbed spiritedly into the dawn, trailing a momentary train of spray that glistened for an instant in the sunlight above the mist. Soon enough, the remaining condensation turned white and opaque, forming little flowers where the panes of his windscreen were jointed into their frames. Gelvarry held the stick between his knees and smoothed his gloves tighter over his hands, which retained little trace of their former trembling.

Up around Paschendaele they were dodging numbly among some clouds when Gelvarry suddenly plucked his Very pistol from its metal clip in the cockpit and fired a green flare. Nigger and O'Sullivan jerked their courses around into exact conformity with his as they, too, now saw the *staffel* of Albatros falling upon them. They pointed their noses up at a steep angle toward the *Boche*, giving the engines more throttle to prevent stalling, and briefly testing the firing linkages of their twin Vickers guns. Tracer bullets left little spirals of white smoke in the air beyond Gelvarry's engine, to be sucked up immediately as he nibbled in behind them. He glanced at Landsdowne and Paddy, raising one thumb. They clenched their fists and shook them, once, twice, toward the foe who, mottled with garish camouflage, dropped down with flame winking at the muzzles of the Spandau *maschingewehren* behind the gleaming arcs of their propellers.

Gelvarry felt they were firing too soon. Nevertheless, there was an abrupt drumming upon his left upper plane, and then a ripping. He saw a wire suddenly vibrate its middle portion into invisibility as a slug glanced from it. There was no damage of consequence. He held his course and refrained from firing, only thinking of how the entire aircraft had quivered to the drumming, and of how when the fabric split it was as if something swift and hot had seared across the backs of his hands. It was Gelvarry's professional opinion that such moments must be fully met and studied within the mind, so that they lose their power of surprise.

There were eight Albatros in the diving formation, he saw, and therefore there might be as many as four more stooging about in the clouds waiting to follow down stragglers.

The stench of overheated castor oil came back from his engine and coated his lips and tongue. He pushed his goggles up onto his forehead, hunched his face down into the full lee of the windscreen, and now, when it might count, began firing purposeful short bursts.

The Albatros is a difficult aircraft to attack head-on because it has a metal propeller fairing and an in-line engine, so that many possible hits are deflected and the target area is not large. On the other hand, the Albatros is not really a good diver, having a tendency to shed its wings at steeper angles. Gelvarry had long ago reasoned out that even an apparently sound Albatros mainplane is under considerable stress in a dive, and so he fired a little above the engine, hoping to damage the struts or even the main spar, but noting that as an inevitable consequence there might also be direct or deflected hits on the windscreen. He did not wish to be known as a deliberate shooter of pilots, but there it was.

The *staffel* passed through the flight of SE-5s with seven survivors, one of which, however, was turning for home with smoke issuing from its oil cooler. The three British aircraft, necessarily throttling back to save their engines, began to mush out of their climbing altitude. Three Albatros which had been waiting their turn now launched a horizontal attack.

His head swiveling while he half-stood in the cockpit, searching, Gelvarry saw the three fresh Albatros emerge from the clouds. Below him, six of the original assault were looping up to rejoin. On his right, Paddy's aircraft displayed miscellaneous splinters and punctures of the empennage, and was trailing a few streamers of fabric, but appeared to be structurally sound. O'Sullivan, however, was beating at the breechblock of one of his guns with a wooden mallet, one hand wrapped around an interplane strut to hold him forward over the windscreen, the other busy with its hammering as it tried to pop out the overexpanded shell casing. His aircraft was wallowing as he inadvertently nudged the stick back and forth with his legs.

On the left, Nigger was nose-down, his airscrew windmilling, ropy smoke and pink fire blowing back over the cockpit. For a moment, the SE-5's ailerons quickly flapped into a new configuration, and the rudder and elevators came over as Landsdowne tried to sideslip the burning. But they were in any case at 7000 feet and at this height there was really no point to the maneuver. Landsdowne stood up in the cockpit as the aircraft came level again, saluted Gelvarry, and jumped, his collar and helmet thickly trailing soot.

"So long, Nig," Gelvarry murmured. He glanced up. A mile above them, the silvery flash of sunlight upon the *Ticonderoga*'s flanks dazzled the eye; nevertheless, he thought he could make out the attendant cloud of dark midges who were the high squadron. He looked to his right and saw that O'Sullivan was being hit repeatedly in the torso by gunfire, white phosphorus tracer spirals emerging from the plucked leather of his coat.

Gelvarry took in a deep breath. He pushed his aircraft into a falling right bank, kicked right rudder, and passed between two of the oncoming Nazis. He converted the bank into a shallow diving roll, and so went down through the climbing group of Albatros at an angle which made it useless for either side to fire. He had also placed all his enemies in such a relationship to him that they would have had to turn and dive at suicidal inclinations in order to overtake him as he darted homeward.

He flew above the remains of villages that looked like old bones awash in brown soup, and over the lines that were like a river on the Moon, its margins festooned with wire to prevent careless Selenites from stumbling in. A high squadron aircraft dropped down and flew beside him for a while, as he had heard they sometimes did lately.

He glanced over at the glossy stagger-wing biplane, its color black except for the white-lettered unit markings, a red-and-white horizontally striped rudder panel, and the American cocardes with the five-pointed white star and orange ball in the center. The pilot was looking at him. He wore a pale yellow helmet, goggles that flashed in the sun, and a very clean white scarf. He raised a hand and waved reservedly, as one might across a tier of boxes at the concert hall. Then he pulled back on his stick and the black aircraft climbed away precipitously, so swiftly that Gelvarry half-expected a crackling of displaced air, but instead heard, very faintly over his own engine, the smooth roar of the other's exhaust. He found that his own right hand was still elevated, and took it down.

He came in over the poplars, and found that he was going to land crosswind. Ground personnel raised their heads as if they had been grazing at the margins of the runway. He put it down anyhow, swung it about and taxied toward the hangar, blipping the engine to keep the cylinder heads from sooting up, and finally cut his switch

near where Sergeant-Major MacBanion was standing waiting with the little gray monkey perched on his right shoulder. As the engine stopped, the cold once again settled into Gelvarry's bones.

"All right, Sir?" Sar'n-Major Mac asked, looking up at him. The monkey, too, raised its little Capuchin face, the small lobstery eyes peering from under the brim of a miniature kepi.

Gelvarry put his hands on the cockpit rim, placed his heels carefully on the transverse brace below the rudder bar, and pushed himself back and up. Then he was able to slip down the side of the fuselage. He stood slapping his hands against his biceps.

Sergeant-Major MacBanion put a hand gently on his shoulder. "And the remainder of the flight, Sir?"

Gelvarry shrugged. He pulled off his helmet and goggles and stuffed them into a pocket of his coat. He stamped his feet, despite the hurt. Then as the cold began to leave him, he merely stood running his hands up and down his arms, and hunching his back.

"Never mind, Sir," Sar'n-Major Mac said softly. "I've come to tell you we've had an urgent message. You're posted to high squadron immediately, Sir."

Gelvarry found himself weeping silently.

"Follow me to Major Harding's hut, please, Sir," Sergeant-Major MacBanion said quietly and gravely. "Don't concern yourself about the aircraft—we'll see to it."

"Thank you," Gelvarry whispered. He walked behind the spare, erect figure to the Major's hut, watching the monkey gently waving the swagger stick. Then he waited outside, rubbing his hands over his cheeks, feeling the moisture trapped between his palm and the oil film on his skin. He hated the coating in his nostrils and on the roof of his mouth, and habitually scraped it off his lips between his teeth.

Sergeant-Major MacBanion came out of the dark hut, shut the door positively, said "That's all right, then, Sir," turned his face slightly and shouted: "Private Parkins on the double if you please!"

Parkins came running up with a thud of boots on damp cinders and saluted energetically. "Yes, Sar'n-Major?"

"Parkins, I want you to list three reserve flying personnel with appropriate aircraft for this afternoon's sweep. Make it the three senior men. What flying personnel will that leave at this station during the afternoon hours?"

"Two, Sar'n-Major, in addition to this officer." Parkins nodded slightly toward Gelvarry without taking his eyes off Sergeant-Major MacBanion's steady gaze.

"Don't concern yourself with this officer, Parkins; Chaplain and I'll be taking care of him."

Parkins brought out the sapient manner he had been withholding. "Right, Sar'n-Major. I'll just have Major Harding send them other two

officers over to Wing in the Rolls to sign for some engine spares, and that'll clear the premises nicely. I'll take the time to sort through this officer's kit for shipping home, then, as well, shall I?"

"I think not, Parkins," Sergeant-Major MacBanion said meaningly, and Parkins could be seen to bob his Adam's apple. "That is Major Harding's duty. That's what commanding officers are for." The thick, neatly clipped brows drew into a speculating frown. "You're slipping very badly, aren't you, Parkins? I wonder what a rummage through your duffel might turn up; I can't say I care for the smell of your breath."

"Hit's mouthwash, Sar'n-Major!" Parkins exclaimed. "A bit of a soother for me sore bicuspid, like!"

"I'll give you sore, Private Parkins, I surely will," Sergeant-Major Mac declared. "Pull yourself together long enough to attend to your own tasks. You're to telephone Wing for three replacement flying personnel to join here tonight, correct? And there's the lorry and the working party to organize; I want this officer's aircraft crashed *and* burning, no doubt about it, *in* No Man's Land, *be*fore teatime, and *if* that's all quite sufficiently clear to you, my man, you *will* see to it forth*with*!"

Parkins saluted, about-faced, and trotted off, sweating. The Sergeant-Major smiled thinly after him, then turned to Gelvarry, "This way, then, please, Sir," he said, and stepped onto the footpath worn through the scrub beside Major Harding's hut.

Following him, Gelvarry was startled to note the neatly cultivated domestic vegetable plot behind the rusty corrugated sheet-iron of the Major's dwelling. There were seed packets up on little stakes at the ends of rows, and string stretched in a zig-zag web for runnerbeans. Lettuce and carrots were poking up tentatively along one side, and most of the rows were showing early evidence of shooting. A spade with an officer's cap dangling over the handle was thrust into a dirt-encrusted pile of industrial furnace clinkers that had apparently been extracted from the soil.

"Padre!" Sergeant-Major MacBanion called ahead. "Here's an officer to see you!"

Father Collins thrust his head around the fly of his dwelling tent, which was situated beyond the shrubs screening Major Harding's hut from this far end of the aerodrome. He was a round-faced man of kindly appearance whom Gelvarry had occasionally seen in the mess, fussing with the Sparklets machine and otherwise making himself useful and approved-of. He came and moved a little distance toward them along the path, and then waited for them to come up. He put out his hand to shake Gelvarry's. "Always here to be of help," he said.

Sergeant-Major MacBanion cleared his throat. "This'll be a high squadron posting, Padre."

Father Collins nodded a little crossly. "One gathers these things, Sergeant-Major MacBanion. Well, young

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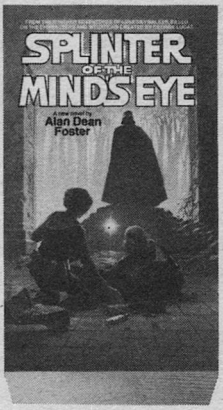

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fellah, let's get to it, then, shall we?" His expression softened and he studied Gelvarry's face carefully. "No need prolonging matters, then, is there? Not a decision to be taken lightly, but, once made, to be followed expeditiously, eh?" He put an arm around Gelvarry's shoulders. Gelvarry found himself grateful for the animal warmth; the cold had been at his ribs again. He went along up the path with Father Collins and Sar'n-Major Mac, and when they reached the little overgrown rise where Father Collins's tent was situated, he stopped. He found he was looking down at a revetment where the transition aircraft was kept.

He walked around and around, a slight smile on his lips, ducking under the planes and squeezing by the end of the rudder where it was nearly right up againt the rear embankment. He ran his fingertips lightly over the impeccably doped fabric and admired the workmanship of the rudder and elevator hinges, the delicately shaped brass standoffs that gave extra purchase to the control cables. Everything was new; the smell of the aircraft had the tang of a fitter's storage locker.

He stopped and faced it from outside the revetment. The slim black aircraft pointed its rounded nose well up over his head; it was much larger than he'd expected from seeing one in the air; he'd thought perhaps the pilot was slightly built.

It rested gracefully upon its two fully spatted tires, with a teardrop-shaped auxiliary fuel tank nestled up between the fully faired landing gear struts. Its rest position on its tailskid set it on an angle such that the purposefully sturdy wings grasped muscularly at the air. A glycol radiator slung at the point of the cowling's jaw promised to sieve with jubilation through the stream hurled backward by the three-bladed metal airscrew.

There were very few wires; the struts appeared to be quite thin frontally, but were faired back for lateral strength. It would, yes it would, burgeon upward through the air with every ounce of power available from that promising engine hidden behind the lovingly-shaped panels, and it would stoop like a bird of prey. It would not creak or whip in the air; its fuselage panels would not drum and ripple; the dope of its upper surfaces would not star and flake off under the compression of warping wings in a battle maneuver, and one would not find, after a hundred hours, that the planes and the stabilizer had been permanently shaken out of alignment with each other.

This aircraft had the same markings as the one that had flown down briefly, except for the actual numerals. In addition to the national cocardes, it also bore a unit insigne—a long-barreled flintlock rifle crossed upon a powderhorn.

Gelvarry felt a prickling pass along the short hairs of his forearms as he thought of flying under that banner. A great-great-uncle was reputed in his family to have been among that com-

pany vanished in search of Providence Plantations, as others had done in attempting to find Oglethorpe's Colony or the fabled inland cities of Virginia Dare's children. North America was a continent of endless forest and dark rumor. And yet something, it seemed—some seed possessed of patience—had been germinating *Ticonderoga*s and aircraft construction works all the while, and within reach of Mr. Churchill's remarkable winnow.

"This is the Curtis P6E 'Hawk,' " Sar'n-Major Mac said at his elbow. "This model is the ultimate development of what will be considered the most versatile armed chase single-place biplane ever designed. The original airframe will be introduced in the mid-1920s. As you see it here, it is fitted with United States Army Air Corps-specified in-line liquid-cooled four-stroke engine developing 450 horsepower, and two fixed quick-firing 30-calibre machineguns geared to shoot through the airscrew. The U.S. Navy version, known as the 'Goshawk,' will use the Wright 'Whirlwind' radial air-cooled engine. Both basic versions are very highly thought of, will remain in service in the U.S. until the mid-1930s, and a few 'Hawk' versions will be used by the Republican air forces in the Spanish Civil War, should that occur."

Father Collins had been up at the cockpit, leaning in to polish the instrument glass with a soft white cloth. He came down now, pausing to wipe the step let into the fuselage and the place on the wing root where he had rested his other foot.

"All quite ready now," he said, carefully folding the cloth and putting it away in his open-mouthed black leather case. He rested his hand on Gelvarry's shoulder. "We've kept her in prime condition for you, lad—no one's ever flown her before; Sar'n-Major and I just ticked her over now and then, kept her clean and taut; the usual drill."

Gelvarry was nodding. As the moment drew near, he found himself breathing with greater difficulty. Tears were gathering in his eyes. He turned his face away awkwardly.

"Now, as for the hooking on," Sergeant-Major MacBanion was saying briskly, "I'm certain you'll manage that part of it quite well, Sir." He was pointing up at the trapeze hook fixed to the center of the mainplane like the hanger of a Christmas-tree ball, and Gelvarry perforce had to look at him attentively.

"Pity there's no way to rehearse the necessary maneuver, Sir," Sar'n-Major Mac went on, "but they say it comes to one. Only a matter of matching courses and speeds, after all, and then just easing up in there."

Gelvarry nodded. He still could not speak.

"Well, Sir," the Sergeant-Major concluded. "Care to try a few circuits and bumps around the old place before taking her to your new posting? Get the feel of her? Some prefer that. Many just climb right in and go off. What'll it be, Sir?"

Gelvarry found himself profoundly disturbed. Something was rising in his chest. Father Collins looked at him narrowly and raised his free hand toward MacBanion. "Perhaps we're rushing our fences, Sergeant-Major. Just verify the cockpit appurtenances there and give us a moment meanwhile, will you?" He turned Gelvarry away from the aircraft and sauntered beside him casually, his arm around Gelvarry's shoulders again.

"Troubles you, does it?"

Gelvarry glanced at him.

"But there was no doubt in your mind when you spoke to MacBanion about this, was there?"

Gelvarry blinked, then shook his head slowly.

"It's good sense, you know. You'd be leaving us the other way, shortly, if it weren't for this. Bound to." He dug in his pocket for his pipe and blew through it sharply to clear the stem. "Sergeant-Major's been discussing it for weeks. Thin as a charity widow, he's been calling you, and twice as pale, except for the Hennessey roses in your cheeks, beggin' all flyin' officers' pardon, Sir. He's been wanting to do something about it."

Gelvarry gave a high, short laugh.

Father Collins chuckled tolerantly. "Ah, no, no, Lad, hoping we'd make the choice for you is not the same. We always wait 'til the man requests it. Have to, eh? Suppose a man were posted on *our* say-so; liable to resent it, wouldn't he be, don't you think? Might kick up a fuss. Word of high squadron might reach Home. And we can't have that, now, can we?"

Gelvarry shook his head, walking along with his lips between his teeth, his lustrous eyes on his aimless feet.

"Mothers' marches on Whitehall, questions in Parliament— If they're alive, put 'em back on duty or bring 'em home to the shellshock ward— that sort of thing. Be an unholy row, wouldn't you think? And so much grief renewed among the loved ones, to say nothing of the confusion; it would be cruel. Or what would they say at the Admiralty if officers and gentlemen began discussing another Mr. Churchill, he cruising about the skies like the Angels of Mons, furthermore? For that matter, I imagine *their* Mr. Churchill would have quite a bit to say about it, and none of it pleasant to the tender ear, eh?"

Gelvarry smiled as well as he was able. He had never laid eyes on or heard the young Mr. Churchill; he imagined him a plump, shrill, prematurely balding fellow in loosely tailored clothing, gesturing with a pair of spectacles.

Father Collins gently turned Gelvarry back toward the aircraft. "We'll miss you, too, you know," he said quietly. "But we must move along now. It's best if other flying personnel can't be certain who's in high squadron and who's left us in the old stager's way, don't you agree? Gives everyone a bit of something to look forward to as the string shortens. MacBanion's a genius at clearing the field, but time *is* passing. Don't worry, Boy—Major Harding does a lovely job of seeing to

it nothing's sent home as shouldn't be, and of course I'll be conveying the tidings by my own hand." They were back beside the P6E. Sergeant-Major MacBanion was standing stiffly attentive, the monkey in the crook of his arm, one small hand curled around the butt of the swagger stick.

"I believe I'll try taking her straight out, Sergeant-Major," Gelvarry said.

"Right Sir. That's the way! Just a few things to remember about the controls, Sir, and you'll find she goes along quite nicely."

"And thank you very much, Father. I appreciate your concern."

"Nonsense, my boy. Only natural. Just keep it in mind we're all still hitting the Bavarian Corporal where he hurts; high or low makes little difference. Bit more comfortable up where you'll be, I shouldn't wonder, but I'm sure you've earned it. Tenfold. Easily tenfold."

"Let my family down as easily as you can, will you, Father?" Gelvarry said.

"Ah, yes, yes, of course."

Gelvarry climbed up into the cockpit. He sat getting the feel of how it fit him. He waggled the stick and nudged the rudder—there were pedals for his feet, rather than a pivoted bar, but the principle was the same.

Sar'n-Major Mac got up on the lower plane root and leaned into the cockpit over him. "Here's your magneto switch, and that's your throttle, of course; some of these instruments you can just ignore—can't imagine why a real aviator'd want them, tell the truth—and this is a wireless telegraphy device, but you don't need *that*—can you imagine, from the way the seat's designed when Padre and I take 'em out of the shipping crate, I'd say you were intended to be sitting on a parachute, of all things; get yourself mistaken for a ruddy civilian, next thing—but this, here's, your supercharger cut-in."

"Supercharger?"

"Oh, right, right, yes, Sir, no telling how high you might find *Ticonderoga*; things could be a bit thin. And in that vein, Sir, you'll note this metal bottle with petcock and flexible tubing. That's your oxygen supply; simply place the end of the tube in your mouth, open the petcock as required, and suck on it from time to time at altitudes above 12,000 feet, or lower if feeling a bit winded. Got all that, Sir?"

"Yes, thank you, Sar'n-Major."

"Very good! Well, then, Sir, Padre'll be wanting another brief word with you, and then anytime after that, we'll just get her started, shall we? I understand the Navy type has a crank thing called an inertia starter, but the old familiar way's for us. After that, I'd suggest a little taxiing for the feel of the controls and throttle, and then just head her into the wind, full throttle, and pleasure serving with you, Sir, if I do say so. You'll find she favors her nose a little, so keep throttle open a bit until you bring her nearer to level; I imagine she stalls something ferocious. But there'll be no trouble; never had any trouble yet. Just head

west and look about; you'll see your new post up there somewhere. Can't really miss it, after all—large enough. Anything else, Sir?"

"No. No, thank you, Ma—Sergeant-Major MacBanion."

MacBanion's right eyebrow had been rising. It dropped back into place. He patted Gelvarry manfully atop the shoulder. "That's the way, Sir. Have a good trip, and think of us grubbing away down here, once in a while, will you?" He jumped from the lower plane and Father Collins came up, holding the bag. "Might be a longish flight, Son," he said. "You've had nothing to eat or drink since midnight, I believe. So you'll be wanting some of this." He opened the bag and handed Gelvarry a small flask and a piece of bread. "And there's windburn at those altitudes." He put ointment on Gelvarry's forehead and eyelids. "Have a safe flight," he said.

Gelvarry nodded. "Thank you again." When Father Collins jumped down, Gelvarry ducked his head below the level of the cockpit coaming and wiped his face. He put his arm straight up in the air and rotated his hand.

Sergeant-Major MacBanion and he began the starting procedure.

The aircraft handled very well. He did a long Figure 8 over the aerodrome at low altitude after he'd gotten the feel of it. The ground personnel of course were busy at their various tasks. An unfamiliar figure leaning with one foot on a garden spade waved up casually from behind Major Harding's hut. The monkey perched on a new pineboard crate Father Collins and Sergeant-Major MacBanion were manhandling down into the revetment from the back of an open lorry. As Gelvarry flew over, the little creature scrambled up to the apex of the tilting box, grinned at him, and raised its kepi.

Past the field, Gelvarry did a creditable Immelman turn, gained altitude, settled himself a little more comfortably on the cushion made from a gunny sack stuffed with rags, and flew toward the afternoon sun, looking upward.

The aircraft *was* a joy, he gradually realized. He probed tentatively at the pedals and stick, at first, hardly recognizing he was doing so because he was under the impression his mind was full of confusions and sorrows. But as he held steadily west, his back and his arse heavy in the seat, his mind began to develop a certain wire-hard incised detachment which he recognized from his evenings with the brandy. In fact, as he gained more and more altitude, and began to rock the wings jauntily and even to give it a little rudder so that he set up a slight fishtail, he could almost hear the messroom piano, as it was every day after nightfall, all snug around the stove, grinning at each other if they could, and roaring out: "Warbirds, Warbirds, ripping through the air/Warbirds, Warbirds, fighting everywhere/Any age, any place, any foreign clime/Warbirds of Time!"

Catching himself, Haverman slipped the oxygen tube into his mouth and opened the valve on the bottle. As the dry gas slid palpably into his mouth and down his throat, the squadron theme faded from the forefront of his mind, and he began to fly the aircraft rather than play with it. He reached out, his bared wrist numbingly exposed for a moment between glove and cuff, and cut in the supercharger. There was a thump up forward of the firewall, and the engine note steadied. There was a faint, somewhat reassuring new whine in its note.

He began to feel quite himself again, encased within the indurate fuselage, his dark wings spread stiffly over the crystal-clear air below, the gleaming fabric inviolate as it hissed almost hotly through the wind of its passage. He took another pull on the oxygen. He gazed over the side of the cockpit. Down there, little aircraft were dodging and tumbling, their mainplanes reflecting sunlight in a

sort of passionate Morse. He knew that message, and he drew his head back inside the cockpit. He resumed searching the deepened blue of the sky above him. And in a little bit, he saw a silver glint northwest of the sun. He turned slightly to aim straight for it, and flew steadily.

After a while, Gelvarry noticed that his throat was being dessicated by the steady flow of the oxygen. He shut the valve and spat out the tube. Pulling the Padre's chased silver flask from the bosom of his tunic, he drank from it. He also ate the cold dry bread. He did not feel particularly sustained by the snack, but the flask was quite nice as a present.

As he went, the distant speck took on breadth as well as length, and then details, size, and a gradual dulling down as the silvered cloth covering began to reveal some panels fresher than others, and the effect of varying hands at the brushwork of the doping. It now looked much as it did on those occasions when it hovered above the aerodrome and Mr. Churchill came down in his wicker car at the end of a cable, as he had done in addressing the squadron several times during Gelvarry's posting.

Ticonderoga in flight upon the same levels as the tropopausal winds, however, was even larger, somehow, and the light fell altogether differently upon it, now that he looked at it again. Boring purposefully onward, its great airscrews turning invisibly but for cyclic reflections, it filled the very world with a monster throbbing that Gelvarry could not hear as sound over the catlike snarlings of his own engine, but to which every surface of his aircraft, and in fact of his mouth and of the faceted goggles over his eyes, vibrated as if being struck by driving snow.

Ticonderoga suspended a dozen double-banked radial engines in teardrop pods abaft its main gondola; they seemed to float just below its belly like subsidiary craft of its own kind. Gelvarry, who had seen one or two Zeppelin warcraft, was struck by the major differences—*Ticonderoga*'s smoothly tapered rather than bluntly rounded tail and bow; its almost fishlike control surfaces, with ventral and dorsal vertical stabilizers, and matching symmetrical horizontal planes, rather than the kitelike box-sections of the Fuehrer's designs; the many glassed compartments and blisters along the hull, and the smoothly faired main and after gondolas, rather than a single rope-slung control car. But the main thing was the size, of course. He resumed taking oxygen.

As he drew nearer, tucking himself into its shadow as if under a great living cloud, *Ticonderoga* began blinking a red light at him from a ventral turret just abaft the great open bay in its belly amidships. Then three aircraft launched from that yawning hangar, dropping one, two, three like a stick of bombs but immediately gaining flying speed and wheeling into formation around him. He saw their unit numbers were in sequence with his. He waved, and their three pilots waved back.

Gelvarry watched them fascinated. They flew with mesmerizing precision, carving smooth arcs in the air as if on wires, showing no reaction at all to the turbulence back along *Ticonderoga*'s hull. They circled him effortlessly; they in fact created the effect of turning about him while really flying flat spirals along the dirigible's flight path. Gelvarry waved again to show his appreciation of their skill, barely remembering to breathe. His gauntleted hands touched lightly at his own stick and throttle, not so much to make changes as to remind himself that he was flying, too.

One of the P6Es had a commander's broad bright stripe belting its fuselage. As soon as it was clear Gelvarry understood enough to hold while they maneuvered, the flight leader could be seen bringing his wireless microphone to his lips and speaking to *Ticonderoga*. The landing trapeze came lowering steadily down out of the bay, and hung motionless, a horizontal bar streaming along across the line of flight at the end of its complicated-looking latching tether.

The leader looked across at Gelvarry, light shining on his goggles, and pointed to one of the other Hawks, which immediately moved out of formation and approached the trapeze. Gelvarry nodded so the leader could see it; they were teaching him. Then he watched the landing aircraft intently.

The hook rising out of the center of the mainplane was designed very much like a standard snap-hook. Once it had been pushed hard against the trapeze bar, it would open to hook around it, and then would snap shut. The trick, Gelvarry thought as he watched his squadron-mate sway from side to side, was to center the hook on the bar at exactly the right height. Otherwise, the P6E's nose would be forced to one side or the other of the ideal flight line, and there might be embarrassing consequences.

But the pilot brought it off nicely, apparently unconcerned about tipping his airscrew into the tether or slashing his mainplane fabric with the trapeze. He sideslipped once to bring himself into perfect alignment, and put the hook around the bar with a slight throttle-blip that put one little puff of blue smoke out the end of his exhaust pipe. Then he cut throttle, the trapeze folded around the hook to make assurance doubly sure, and he was drawn up into the hangar bay, *allez-oop*! in one almost continuous movement.

In a moment, the trapeze came down again, and the second pilot did essentially the same thing. The other half of the trick was not to create significant differences between the forward speeds of the dirigible and the aircraft along their identical flight lines, and Gelvarry lightly touched his throttle again, without moving it just yet. But when he glanced across at the leader, he was being gestured forward and up, and the trapeze was once more waiting. The leader drifted down and to the side, where he could watch.

Gelvarry took in a good breath from the bottle and came up into the turbu-

lence, well back of the trapeze but at about the right height. He took another breath, and his mind crisped. He touched the throttle with delicate purposefulness, and came inching up on the bar, which was rocking rhythmically from side to side until he put his knees to either side of the stick and rocked his body from side to side, thus rocking the ailerons to compensate, thus revealing that the bar had been quite steady all along, and that he was now reasonably steady with it. He was coming in an inch or two off center. He gulped again at the tube. What can happen? he thought dispassionately, and twitched the throttle between thumb and forefinger, a lefthanded pinball player's move. With a clash and a bang, the hook snapped over and the trapeze folded. He closed throttle and cut the magneto instantaneously, slip-slap, and he was already inside the shadow of the hangar, swaying sickeningly at the end of the tether, but already being swung over toward the landing stage, with a whine of gears from the tether crane, whose spidery latticework arm overhead blended into the shadowy, endlessly repeated lattice girders that formed frame after identical frame, a gaunt cathedral whose groins and mullions retreated into diminishing distances fore and aft, housing the great bulks of the helium bags, interlaced by crew catwalks and ladders, spotted here and there by worklights but illuminated in the main by the featureless old-ivory glow through the translucent hull material.

Suddenly there was no sound immediately upon his ears, except for the pinging of his exhaust pipes and cylinder heads. The great roaring of passage pierced into the air was gone. What was left instead was a distant buzz, and the sighing rush of air rubbing over the great fabric.

The P6E's tailskid, and then its tires, touched down on the landing stage. A coveralled man wearing a hood over his mouth and a bottle on his back stepped up on the lower plane, then reached to the mainplane and disengaged the hook from the trapeze, which was swung away instantly. Other aircraft handlers stood looking impatiently at Gelvarry, who lifted himself up out of the cockpit and down to the jouncy perforated-aluminum deck. Down past his feet, he could see the structures of the lower hull, and the countryside idling backward below the open bay before the leader's Hawk nosed blackly forward toward the trapeze.

He could see almost everywhere within the dirigible. Here and there, there were housed structures behind solid dural sheets or stretched canvas screens. Machinery—winches, generators, pumps—and stores of various kinds might interrupt a line of sight to some extent, but not significantly. Even the helium bags were not totally opaque. (Nor rigid, either; he could see them breathing, pale, and creased at the tops and bottoms, and he could hear their casings and their tethers creaking). He felt he could shout from one end of *Ticonderoga* to the other;

might also spring into the air toward that stanchion, swing to that brace, go hand over hand along the rail of that catwalk, scramble up that ladder, swing by that cable to that inspection platform, slip down that catenary, rebound from the side of that bag, land lightly over there on the other side of the bay and present himself, grinning, to his fellow pilots standing there watching him now, all standing at ease, their booted feet spread exactly the same distance apart, their hands clasped behind their backs, their cavalry breeches identically spotless, their dark tunics and Sam Browne belts all in a row above beltlines all at essentially the same height, their helmets on and their goggles down over their eyes.

He licked his lips. He glanced up guiltily toward the catwalk higher up in the structure, where a row of naked gray monkeys the size of large children was standing, paws along the railing, motionless, studying things. Gelvarry glanced aside.

The flight leader's plane was swung in and then rolled back to join the dozen others lashed down along the hangar deck. The man had jumped down out of the cockpit; he strode toward Gelvarry now. As he approached, Gelvarry saw his features were nondescript.

"You're to report to Mr. Churchill's cabin for a conference at once," he said to Gelvarry. He pointed. "Follow that walkway. You'll find a hatch forward of the main helium cells, there. It opens on the midships gondola. Mr. Churchill is waiting."

Gelvarry stopped himself in midsalute. "Aren't you going to take me there?"

The flight leader shook his head. "No. I can't stand the place. Full of the monkeys."

"Ah."

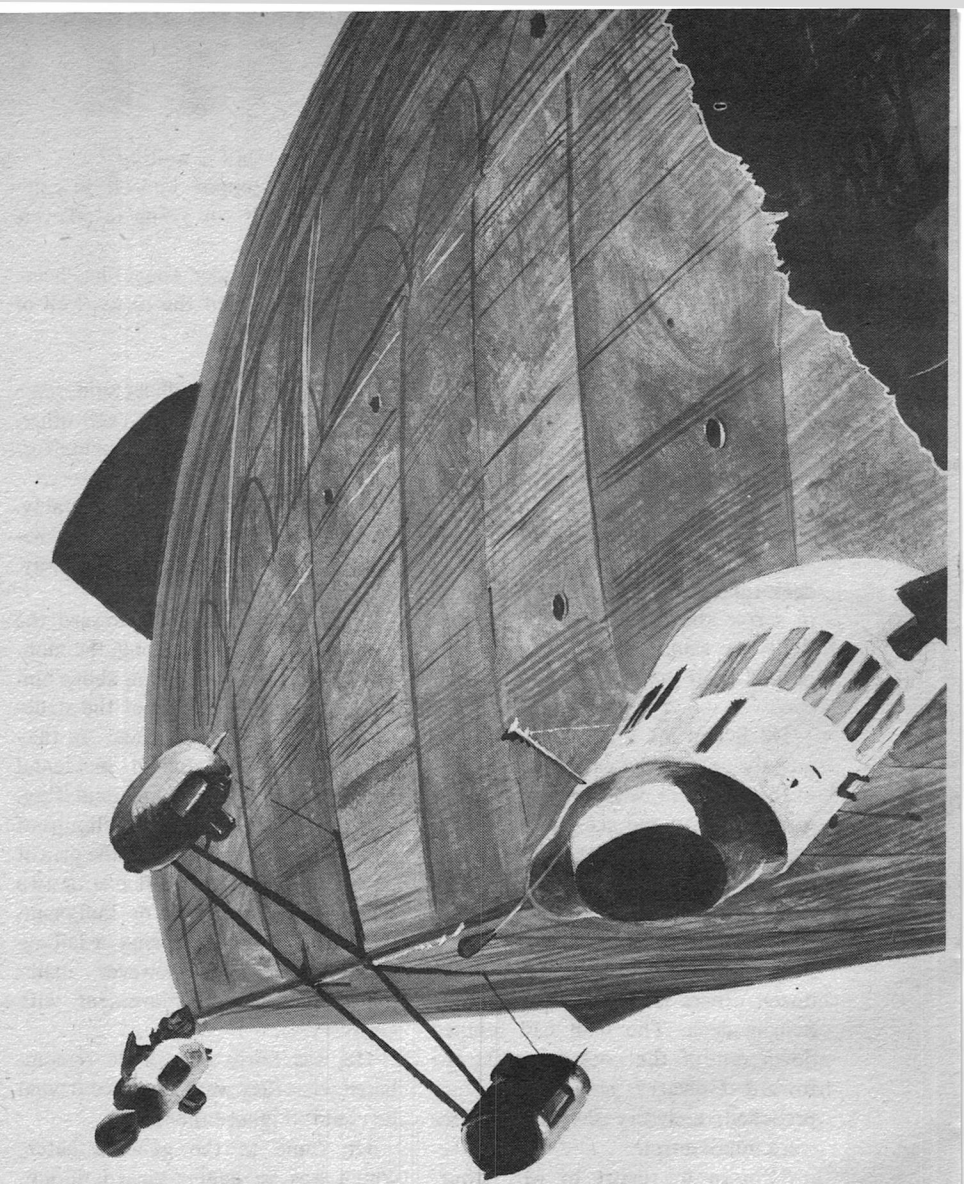
"Good luck," the officer said. "We shan't be seeing more of each other, I'm afraid. Pity. I'd been looking forward to serving with you."

Gelvarry shrugged uncomfortably. "So it goes," he said for lack of something precise to say, and turned away.

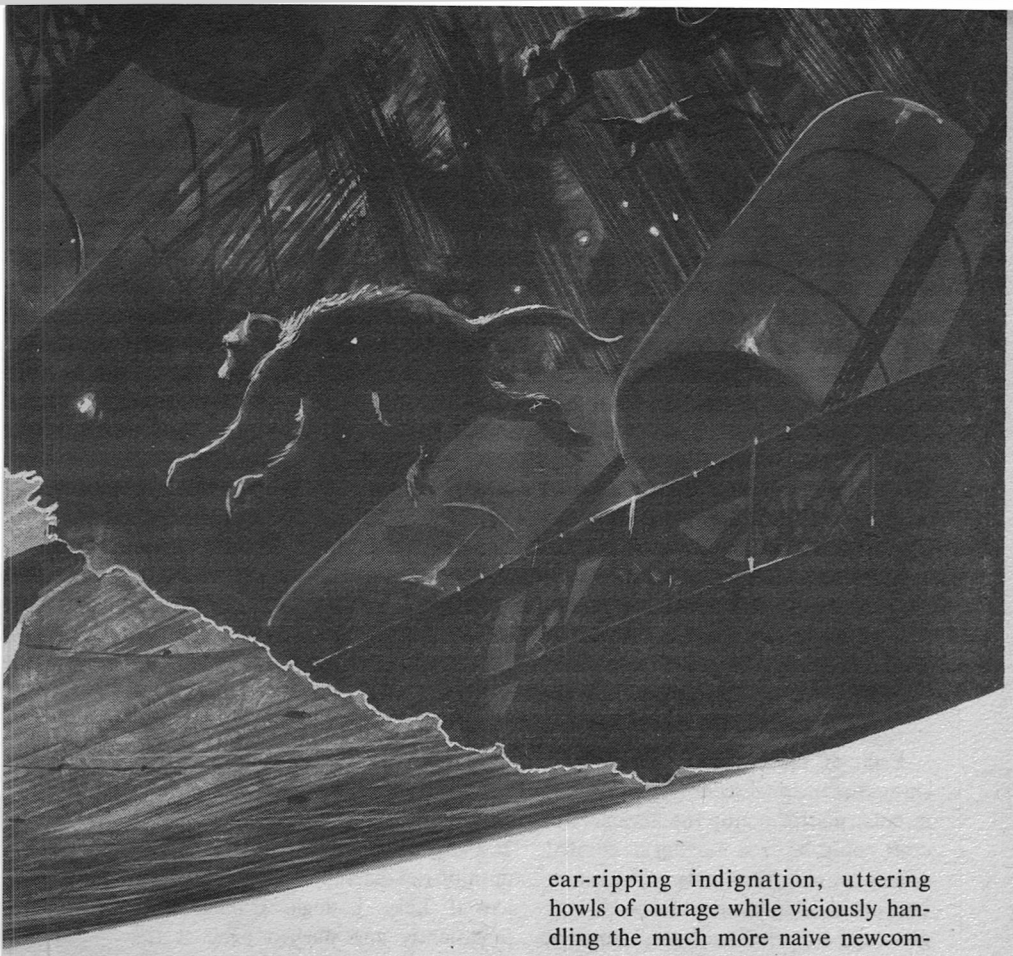
He followed directions toward the gondola. As he moved along, the monkeys flowed limb-over-limb above him among the higher levels of the structural bracing, keeping pace. As they traveled, they conducted incidental business, chattering, gesticulating, knotting up momentarily in clumps of two and three individuals in the grip of passion or anger that left one or two scurrying away cowed or indignant, the level of their cries rising or falling. The whole group, however, maintained the general movement with Gelvarry.

He was fairly certain he remembered what they were, and he did what he could to ignore them.

He came to the gondola hatch, which was an engine-turned duraluminum panel opening on a ladder leading down into a long, windowed corridor lined with crank-operated chest-high machines, at each of which crouched and cranked a monkey



somewhat smaller than Gelvarry. As he set foot on the ladder, several of the larger monkeys from the hull spaces suddenly shoved past him, all bristles and smell, forcing their way into the corridor. They were met with immediate, shrieking violence from the nearest machine monkeys, and Gelvarry swung himself partway off the ladder,



his eyes wide, maintaining his purchase with one boot-toe and one gloved hand while he peered back over his shoulder at the screams and wrestlings within the confined space.

Bloodied intruder monkeys with their pelts torn began to flee back toward safety past him, voiceless and panting, their expressions desperate. The attempted invasion was becoming a fiasco at the deft hands of the machine monkeys, who fought with ear-ripping indignation, uttering howls of outrage while viciously handling the much more naive newcomers. Out of the corner of his eye, Gelvarry saw exactly one of the intruders—who had shrewdly chosen a graying and instinctively diffident machine monkey several positions away from the hatch—pay no heed to the tumult and close its teeth undramatically and inflexibly in its target's throat. In a moment, the object of the maneuver was a limp and yielding bundle on the deck. While all its fellows streamed up past Gelvarry and took, dripping, to the safety of the hull

braces, the one victorious new monkey bent over the dispossessed machine and began turning the crank. No attention was paid to it as things within the gondola corridor returned to normal.

Gelvarry closed and secured the hatch while monkeys returned to their machines. The wounded ones ignored their hurts cleverly. Neither neighbor of the successful invader paid any overt attention to matters as they now stood, but Gelvarry noticed that as they bobbed and weaved at their machines, with the new monkey between them and with the dead cranker supine at his feet, they unobtrusively extended their limbs and tails to nudge lightly at the body, until they had almost inadvertently kicked it out of sight behind the machines.

Each of the machines displayed a three-dimensional scene within a small circular platform atop the device. Aircraft could be seen moving in combat among miniature clouds over distant background landscapes. Doped wings glistened in the sunlight, turning, turning, reflecting flashes. Dot dot dot. Dash dash dash. Dot. Dot. Dot. Gelvarry brushed forward between the busy animals and moved toward the farther hatch at the other end of the corridor. Atop the nearest machine, he saw a Fokker *dreidekker* painted red, whipping through three fast barrel rolls before resuming level flight above the floundering remains of a broken Nieuport. Dot dot dot dash.

The monkey at that machine frowned and cranked the handle backwards. The Baron's triplane suddenly reversed its actions. Dash dot dot dot. The Nieuport reassembled. Stork insignia could be seen painted on its fuselage. The crank turned forward again. The swastika-marked red wings corkscrewed into their victory roll again above the disintegrating Nieuport.

The monkey at the machine was crooning, and bouncing on the balls of its feet, rubbing its free hand over its lips. It moved several knobs at the front of the viewing machine, and the angle changed, so that the point of view was directly from the cockpit of the Fokker, and pieces of the Nieuport flew past the wing struts to either side. The monkey jabbed its neighbors with its elbows and nodded toward the action. It searched the face on either side for reaction. One of them, turning away from a scene of Messerschmitt 262 tactical fighters rocketing a column of red-starred T-34 tanks on the ice of Lake Ladoga, glanced over impatiently and pushed back at the Fokker monkey's shoulder, resuming its attention to its own concerns. But the other neighboring monkey was kinder. Despite the fact that its flight of three Boeing P-26s was closing fast on a terrified Kawanishi flying boat over the Golden Gate Bridge, it paused long enough to glance at the Baron's victory, pat its neighbor reassuringly on the back, and utter a chirp of approbation. Pleased, the first monkey was immediately rapt in rerunning the new version of the scene. The kind

monkey stole a glance over again, shrugged, and resumed cranking its own machine.

Gelvarry continued pushing between the monkeys to either side. The flooring was solid, but springy underfoot. The ceiling was convex, and wider than the floor, so that the duraluminum walls tapered inward. They were pierced for skylights above the long banks of machines, but *Ticonderoga* was apparently passing through clouds. There were rapid alterations of light at the ports, but only slight suggestions of any detail. Over the spasmodic grinding of the cranks, and the constant slight vocalizations of the monkeys, the sound of air washing over the walls and floor could be made out if one paused and listened ruminatively.

Gelvarry reached Mr. Churchill's compartment door. He knocked, and the reassuring voice replied: "Come!" He quickly entered and closed the sheetmetal panel securely behind him.

The compartment was large for his expectations. Its deck was parqueted and dressed in oriental carpets. Armchairs and taborets were placed here and there, with many low reading lamps, and opaque drapes swayed over the portholes. Mr. Churchill sat heavily in a Turkish upholstered chair at the other end of the room, facing him, wearing his pinstriped blue suit with the heavy watchchain across the rounded vest. He gripped a freshly lighted Uppman cigar between his knuckles. The famous face was drawn up into its wet baby scowl, and Gelvarry at once felt the impact of the man's presence.

"Ah," Mr. Churchill said. "None too soon. Come and sit by me. We have only a moment or two, and then they shall all be here." His mouth quirked sideward. "Rabble," he growled. "Counterjumpers."

Gelvarry moved forward toward the chair facing the Prime Minister. "Am I a unique case, Sir?" he said, sitting down with a trace of uneasiness. "I was told high squadron posting was voluntary only."

Mr. Churchill raised his eyebrows and turned to the taboret beside him. He punched a bronze pushbell screwed to the top. "Unique? Of course you're unique, man! You're the principal, after all." A doorway somewhere behind him opened, and a young woman with soot-black hair and bee-stung lips entered wearing a French maid's costume. She brought a silver tray on which rested two crystal tumblers and a bottle of the familiar Hennessey *Rx Official*. "Very good! Very good!" Mr. Churchill said, pouring. "Mr. Dunstan Haverman, I'm introducing Giselle Montez," he said, giving her name the Gallic pronunciation. "It is very possible that you shall—" He shrugged. "Meet again." Gelvarry tried not to appear much out of countenance as she brought the salver and stood gracefully silent, her eyes downcast, while he took his tumbler. "Charmed," he said softly.

"Thank you," she murmured,

turned, and retreated through her doorway. She had left the bottle with Mr. Churchill.

Gelvarry sipped. Mr. Churchill raised his glass. "Here's to reality."

Haverman shuddered. "No," he said, drinking more deeply anyway, "I was beginning to depend on it too much. Sam, what's going wrong?"

Sam grunted as the amber liquid hit his own esophagus. He was normally a self-contained, always pleasant-spoken individual—the typical golf or tennis pro at the best club in the country—who in Haverman's long experience of him had once frowned when a drunk at a business luncheon had pawed a waitress. And then calmly tipped a glass of icewater into the man's lap, costing himself a 39-week deal.

"Sam?" Haverman peered through the Hennessey effect at his grimacing old acquaintance.

"Take a look." The leaner, longer-legged, short-haired man sitting in the chrome-and-leather captain's chair turned toward the hard-edged cabinet standing beside him. The pushbell atop it seemed incongruous. Sam flipped up a panel and punched a number on the keyboard behind it. He closed the panel and nodded toward a cleared area of the paneled, indirectly lighted room. Haverman immediately recognized it as a holo focus, of course, even before he remembered what an inlaid circle in the flooring signified. It was a large one—half again the size of normally sold commercial receivers—as befitted the offices of a major industry figure.

Laurent Michaelmas appeared; urbane, dark-suited, scarlet flower in his lapel. "Good day," he said. "I have the news." He paused, one eyebrow cocked, hands slightly spread, waiting for feedback.

Sam raised his voice slightly above normal conversational level. "Just give us the broadcast industry top story, please," he said, and the Michaelmas projection flicked almost imperceptively into a slightly new stance, then bowed and said:

"The top broadcast story is also still the top general story, sir. Now here it is." He relaxed and stepped aside so that he was at the exact edge of the circle, visually related to the room floor level, while the remainder of the holo sphere went to an angled overhead view of lower Manhattan.

"Well, today is October 25, 1992, in New York City, where the impact of the latest FCC ruling is still being assessed by programming departments for all major media." The scene-camera point of view became a circling pan around Wall Street Alley, picking up the corporate logos atop the various buildings: RCA, CBS, ABC, GTV, Blair, Neilsen. In a nice touch, the POV zoomed smoothly on an upper-story window, showing what appeared to be a conference room with three or four gesticulating figures somewhat visible through the sun-repelling glass. It was excellent piloting, too—the camera copter was being handled smoothly enough in the notorious off-bay crosscurrents so that the holo scanner's limited compensatory cir-

cuits were able to take all the jiggle and drift out of the shot. Here was a flyer, Haverman thought, who wouldn't be a disgrace at the trapeze. Then he winced and took another nibble at the Hennessey.

"While viewers reaped an unexpected bonanza," Michaelmas said, and the background cut to an interior of a typical dwelling and a young man and woman watching Laurent Michaelmas with expressions of pleasant surprise, "industry spokesmen publicly lauded the FCC's Reception Release Order." The cut this time was to a pleasant-looking fellow in a casual suit, leaning against a holo cabinet. He smiled and said: "Folks, it's got to be the greatest thing since free tickets to the circus." He patted the cabinet. "Imagine! From now on, you can receive *every* and *any* channel right where you are, no matter *what* type of receiver you own! Yes, it's true—for only a few pennies, we'll bring you and install one of the new Rutledge-Karmann adapter units, with the best coherer circuit possible, that'll transform any receiver into an *all-channel* receiver! Now, how about that? Remember, the government says we have to use top-quality components, and we have to sell to you at *our cost*! So—" He grinned boyishly, "even if we wanted to screw you, we can't."

"Others, however," Michaelmas said, "were not so sanguine. Even in public."

The holo went to Fingers Smart in the elevator lobby of what was recognizably the New York FCC building. He was striding out red-faced, followed by several figures Haverman could recognize as GTV attorneys and GTV's favorite consulting lawyer. "When interviewed, GTV Board Chairman Ancel B. Smart had this to say at 1:15 PM today:"

Now it was a two-shot of Smart being faced by an interested, smiling Laurent Michaelmas, while the lawyers milled around and tried to get a word in edgewise. Nobody ever effectively got between that friendly-uncle manner of Michaelmas's and whomever he was after.

"That's exactly right, Larry," Smart was saying. "We built the holovision industry the way it is because the FCC wanted it that way then. Now it wants it another way, and that's it. Public interest. Well, damn it, we're part of the public, too!" Smart's other industry nickname was Notso.

"Are you going to continue fighting the ruling?"

A belated widening of Smart's eyes now occurred. "Who says we're fighting it? We were here getting clarification of a few minor points. You know GTV operates in the public interest."

Sam chuckled unamused while Haverman peered and thought. GTV controlled eighty-seven entertainment channels that operated twenty-four hours a day. There were six GTV-owned channels leased to religious and political lobbies. There was also, of course, GTV's ten percent share of the public network subsidy. Paid off in programs given to PTV from the sum-

mer Student Creative internship plan.

That was how the dice had fallen when the Congress legislated cheap 3-D TV. The existing broadcast companies were trapped in their old established images with heavy emphasis on sports or news, women's daytime, musical variety, feature documentary anthologies, and the like. That had left an obvious vacuum which GTV had filled promptly.

All-channel receivers at an affordable price had been out of the question. As usual, Congress had been straining technology to its practical limits, and compromises had had to be made in the end. A good half of the receivers sold, Haverman remembered, were entertainment-only. Now, apparently, because of something very cheap called the Harmon-Cutlass or something, he wouldn't have to remember it any longer.

"Oh!" he said, raising his eyes to Sam's nod.

Michaelmas cocked his head at Smart. "Just one or two more questions, please. Are you saying you haven't already cut your ratings guarantees to your advertisers? I believe your loss this quarter has just been projected at nearly twenty percent of last year's profits."

Smart glanced aside to his legal staff. But he was impaled on Michaelmas's smile. He tried one of his own; it worked beautifully at the annual entertainment programming awards dinner. "Come on, Larry—you know I'm no bean-counter. GTV's going to continue to offer top-drawer—"

"Well, one would assume that," Michaelmas said urbanely. "You have most of the season's product still on the shelf, unshown. No one would expect you to just dump a capital investment of that scope. What is your plan for after that? Or don't you expect to be the responsible executive six months from now?"

"Ouch!" Haverman said.

"I don't think I have to answer that here," Smart said quickly. He frowned at Michaelmas as he moved to step around him. "Come to think of it, you're in competition with us now, aren't you?" He actually laid a hand on Michaelmas's arm and pushed him a little aside, or would have, if Michaelmas didn't have a dancer's grace. "No further comment," Smart said, and strode off.

Michaelmas turned toward the point of view, while the background faded out behind him and left him free-standing. He shrugged expressively. "These little tiffs sometimes occur within the fellowship of broadcasting," he said with a smile. "But most observers would agree that competition is always in the public interest." There was the faintest of flicks to a stock tape; computer editing was instantaneous in real time, smooth, and due to become smoother. Even now, only an eye expecting it could detect it. "And that's how it is today," flick, "in broadcasting," flick, "and in the top story at this hour." He bowed and was gone.

Haverman rolled his eyes. "What

happened?" he said. "I thought Hans Smart had a lock on Congress."

Sam grinned crookedly and grimly. "He's dead, poor chap. His liver gave out two weeks ago, and there went Notso's brains."

"Physiology got to the wrong brother."

"Yeah. It wouldn't have been as bad as it was, but three days before he went, NBC sprang a prime-time documentary. It was about this new little engineering company in Palo Alto that could pick up all channels on your $87.50 Sony portable. He wasn't cold in the ground before a dozen senators were on the all-channel bandwagon. The House delegation from California began lobbying as a bloc, New York City and then Nassau and Dutchess counties jumped in, and the next you know Calart-Hummer or whatever it is, is the law of the land. Hans Smart could handle legislators with the best of 'em, but I don't think it was the booze that killed him; it was that friggin' feature."

Sam grinned more genuinely. "It was a beaut. NBC sent out engraved invitations; on paper, messenger-delivered to every member of Congress and anybody else they figured could swing a little. About six months ago, they had bought excerpt rights to about a dozen old *Warbirds* things. Newsfeature use only; you know how that goes, I guess. Well, it all turned up in that show. Michaelmas walking around narrating over it. Only they scaled it down behind him, so he was just stepping around over the battlefields and the planes were buzzing around him while he just smiled and talked. King damned Kong in a pinstripe suit. You wouldn't have believed it. Show it to you sometime; everybody in the business must have made a copy of it. Scare hell out of you. Even if you weren't personally involved, I mean."

Haverman sucked a little more Hennessey carefully between his lips and across the edges of his tongue. "What's been happening to the *Warbirds* ratings, Sam?"

Ticonderoga Studios produced other things besides *Warbirds,* but *Warbirds* was what it was known for in the industry, and *Warbirds* was GTV's top-rated show. GTV's contract was what kept Ticonderoga flying.

"Well, Dusty, we're having to be ingenious." Sam looked down at the stick between his fingers, then broke it open and inhaled in a controlled manner. "These things are pretty good," he remarked. "I think they'll catch on."

Haverman settled himself carefully in his chair. "Isn't this thing bound to settle out? I mean, it's a new toy. Notso may flail around for a little while—"

Sam nodded, but not encouragingly. "He's gone. He knows it. But he's telling himself he can make it unhappen if he just yells and shits loud enough. Flailing around isn't the phrase you need. But he's gone. I've got some GTV stock: want it?"

"It'll work its way back up again, Sam," Haverman said carefully. "Especially if Smart gets kicked out by

the Board and they hire a new president." Haverman suddenly sat up straighter. "Hey, Sam, why couldn't that be you?"

"I've thought about that."

"Right! It's perfect for them—a top gun from outside, but not too far outside. An experienced new broom. The PR is made for it, friend!"

"I don't want it."

Haverman looked at him watchfully. "Oh?"

Sam shook his head. "Too soon. I'm staying right where I am and building a record. Some other poor son of a bitch can have the next couple of years to get ulcerated in."

Haverman pursed his lips thoughtfully. "It's going to be that bad." He had one hundred percent respect for Sam's judgment. "I guess I'm being a little slow. If our people can switch away to other channels, can't their people switch to GTV?"

"All of them can and some of them will. But they're hardcore generalists; they'll take a little of us, and a little of CBS, and a little of NBC, and a little of Funkbeobachter, and a little Shimbun, and some ABC, and God knows what else when the new relay sats go in. No, these are the kind of people that're used to a little of everything, no matter what network they're from. Any of 'em that hankered for a little side action from GTV or anyplace else could afford additional sets long ago. But *our* people, you know—" He held his hand out, palm up, and slowly turned it over.

Haverman said reluctantly: "That's not how we talk at the awards dinners."

"I don't see any chicken and peas around here right now," Sam said. "There's no way I would have pulled you out of your milieu if I didn't think we were in trouble."

"We can counterprogram," Haverman said emphatically. "We've got the skills and the facilities."

"Yes, I have."

"Okay. We can do news and sports stuff like the other people. That's the way it's going to go anyhow—back to the way it was in flat-V time, when everybody had a little of everything."

"Yeah, but not now," Sam said. "Later. Meanwhile, how do we get the National League to break its contract with ABC? Where do you think CBS's legal department would be if we started talking option-breakers to Mandy Carolina? Two years from now, Michaelmas's contract is up for renewal at NBC. There's talk he's thinking of going freelance. *That'll* start a trend. Give me enough bucks, and I'll build you the top-rated action news show. *Then.* Then, Dusty," he said gently. "Not now. And now is when Fingers Smart and old Sam the Ticonderoga are fighting for their lives, you know?" He inhaled deeply on the stick and threw the exhausted pieces to the floor.

"I can't start another league to compete with what ABC can show my people. There aren't that many big jocks in the world. And I can't find another talk show hostess; only God can make a mouth. I can't get Mi-

chaelmas, I can't get Melvin Watson, I can get the guy who's sick of being Skip Jacobsen's Sunday-night backup, and so what. What I've got is actors. I can get actors. I can get enough actors to fill eighty times twenty-four hours of programming every week, if I have to." Sam sighed. "I can make actors. So can anybody else; it's no secret how you do almost two thousand different shows a week, thirty-nine weeks a year. So you know what I've got left?" Sam leaned forward.

"Me," Sam said. "I've got me, and what's in me here." He tapped his head and patted his crotch. "And we're gonna find out how many years it's good for."

The silence had persisted palpably. "And me, Sam," Haverman said finally.

"Uh-huh," Sam said. He poured another shot into Haverman's glass. "Here," he said, and sipped his own to knock off the stick effect. "Have a snort. Now, listen. You're my guy, and don't forget it. You were one of the first people to sign on with me, and you've been the principal of *Warbirds* ever since almost the beginning."

Haverman nodded emphatically. There had been a Rex something or other. But that was long ago. "I have a following," he said confirmingly as if that was what he thought mattered to Sam about him. And of course it was one of the things that did matter. It must. Sam was not a creative for his health.

"That's right," Sam said gently. "And I'm going to protect you, and you're going to help me."

"I'm not going back into *Warbirds*."

"Something like *Warbirds*. Something recognizably like it, and you're going to have the same character name."

Haverman cocked his head. "But there *are* going to be changes."

"Oh, yes. Got to have those, so it can be new and different. But not too many, really—got to save something so they can identify with the familiar. It'll have airplanes and things."

"Ah," Haverman said warily.

"A new show. All your own. Name over the title. We're going to promo hell out of it—'Haverman Moves!' Maybe 'Dusty Moves!' I don't know. Hell with it. Think of something better. Not the point. We'll get every one of the *Warbirds* audience, and with that kind of promo, we'll get plenty of new lookers. Once they've looked, we'll have 'em. Guarantee it."

"Well, certainly, if it's one of your ideas—"

"Hell, yes, it's one of mine. More important, it's the one whose time has come. What the hell—eighty-odd channels of our own for a looker to choose from, and God knows how many more coming from all kinds of places. It's got to happen; I can hit the FCC with First Amendment and Right of Free Choice at the same time. It'll be years before they beat me. And you know something, Duster?" he said in a suddenly calm voice, "I don't think they're ever going to

beat me. I think we really can make it stick."

"Oh?" Haverman felt the skin prickle sharply at the backs of his hands. He had never seen Sam like this; only heard of such moments, when the conviction of having thought and done exactly right transformed his good friend's face. The triumphant force of having created a truth came blazing from his eyes. And when he said "I think we can make it stick," his voice reharmonized itself so that though it never rose in volume, it might have been played by solo viola. Haverman could only say again: "Oh."

Sam was grinning. Grinning. "It's beautiful, Duster," he said. "Once we've beaten the test case, we can do another thing—open up a whole channel to the genre. Maybe more than one. And you shoot the whole thing on one set, with a couple of pieces of furniture and just a handful of props, and a holoprojected background. There's no long shot, and damned little tracking, so you do it with two cameras. One, if you're willing to settle. But I wouldn't. Or at least I'd want a damn good optical reflector to back me up. A whole new show, and then a whole channel full of new shows, for a third—maybe a fourth—of what anything else costs."

"And I'm going to do the first one," Haverman said. "Smart'll go for it. He has to. What kind of show is it, exactly, Sam?"

When Sam explained it to him further, he sat shaking his head. "Oh, no, Sam, no, I'm not sure I could do that."

But Sam said: "Sure you can."

Haverman sat uncertainly through the beginning of the conference. First the door to the office corridor was opened, and the senior technical staff came in; Hal, the most senior, carried a model of an aircraft carrier and a model of a silvery biplane, both of which he set down on Sam's white table. Sam turned them over in his hands, and nodded and winked at Hal, who smiled and sat down in the nearest of the informally-grouped chairs. Dusty sat back along the wall, in a comfortable alcove next to Miss Montez's door, waiting.

Sam looked around at his people. "Everybody ready? Okay, let's give the great man a call," he said, and apparently punched up Ancel Smart's phone number, because Smart, after a little work with a secretary, appeared in the holo circle. He sat in a chair with his own people around him, and said heavily: "Shoot."

"Right," Sam said. "Anse, you know Hal and the rest of the boys, here. Now, we're proposing as follows—"

And it continued from there, with Smart nodding from time to time, or interposing a question, and changing his POV to watch whoever on the Ticonderoga staff was giving him the data. Then he'd turn back to Sam. Occasionally, one of Smart's people would address Sam. But it was Smart and Sam one-on-one, as it ought to be, Dusty saw, beginning to feel better as

his friend clearly established dominance over the meeting. Smart was inclined to cough and play with his chin. Sam sat slim and upright, his hands, spread-fingered, molding premises in the air above the white tabletop where the models waited. Dusty began to feel better as Sam grew.

"All right, I promise you this new show'll grab 'em and won't let go. I've taken a closer look at the tentative figures we discussed earlier, and I'll stand behind 'em." Sam named an in-the-can cost half of what it might have been. "And no concept fee, absolutely nothing in front. I get it back on reruns; we go to full rate on those, but, what the hell, if we ever *see* reruns, you're golden and you don't care, right? Okay, so that's Part One of what Ticonderoga's prepared to do. What do you do, Anse?"

Smart nodded. "Like I said. If it packages up the way you described, GTV'll help with the Feds. We've still got an office in Washington, after all, and my brother left a well-trained staff."

"Specifically, you're agreeing to hold Ticonderoga harmless in the event of criminal penalties or monetary losses caused by legal or regulatory action. Is that correct?"

One of Smart's legal staff suddenly leaned forward and began to whisper urgently in his ear. Smart waved him off impatiently. "That's right. I haven't changed my mind."

"On the record, and on behalf of GTV?" Sam pointed toward his own lawyer, who held up a sealed recorder.

"If we buy the program at all, GTV defends," Smart confirmed.

"Okay," Sam said. "Now I'm gonna tell you who's in it."

"Ah."

"According to the formula we discussed," Sam said, turning to his holo box, talking aside, "we're going for a total ego-spectrum across four archetypical blocs. Now, each bloc embodies several potent identification features. We go young woman, young but experienced man, older and ego-stable woman, fully sophisticated man at the top end of middle age. We go soft, wiry, tight, sinewy; dark, reddish, blondy, silver. Sometimes we vary a little; there's room to do it; you get different overlaps, but you still cover it all the way across your maximized consumer ideals. We anchor at each end with an identifiable regular, but we can vary in the middle. Right so far?"

Smart nodded. "Acceptable." His and Sam's lawyers nodded.

"All right." Sam was still turned toward the control cabinet and speaking along his shoulder at Smart. He began to slowly raise one arm toward the top of the box. It was a good move; Haverman could see the tension building in Smart, and the distraction that was mirrored in the flickering of his eyes. More and more, Haverman felt the welling of admiration for Sam, and the comfort of being one of his people. "Now, you buy the concept of guest celebrities?"

"As long as they fit the formula."

"As long as they fit the formula defined above," Sam corroborated. "Are you worried about our being able to create authenticity?"

"With your makeup and research departments? Never. You guarantee audience believability, and I'll take your word for it right now."

"So guaranteed. Done." Sam nodded. "All right, we work from now on the assumption that the celebrity pair each show will cover the two middle blocks, and Ticonderoga has discretion there as long as the portrayals remain convincing. To whom? Do you want to designate an audience-reaction service, Ancel?" His hand was poised above the holo controls now.

Smart shrugged. "We've been using TeleWinner all along. Let's give 'em this, too. Split the cost, right?" He chuckled. "What the hell, you know the reason GTV buys *Warbirds* is because I'm hooked on it. I'm my own symbol-bloc survey; they just make it official."

Sam smiled faintly. Audience size was what made it official.

"And, what the hell," Smart said, "you're keeping the alternate time tracks premise for the new show, aren't you? So if somebody says Rocky Marciano wasn't lefthanded or Sonja Henie didn't rollerskate, well, hell that was *then* but this is *elsewhen*, right? But it has to *look* right; that we've got to have."

"Absolutely." Even if there'd been no other public source of visual data, there was GTV's own Channel '29, steadily programming out reprocessed old movie and newsreel footage for all the WWII warbabies who'd just missed it. The reprocessing was done by TStudiolab, Inc., one of Sam's subsidiaries.

"Okay, so we've got all that out of the way," Smart said. "Now let's see the goods."

"Of course." Sam smiled. His hand moved unexpectedly, and rang the little pushbell. "Let me introduce our talented newcomer. The next big word in viewer households, known to you and me as the young bloc and all that implies, but professionally known as Giselle Montez—"

On her cue, Miss Montez came through her door in a high squadron pilot's uniform, the leather of her boots and Sam Browne belt glistening. She swept off her aluminized goggles and her helmet with one deft swirl of the hand that released her cloud of hair, and stood holding them on her hip, while her other hand rested its fingertips at the first button in the vee of her tunic. Ancel Smart leaned forward sharply in his chair. His mouth formed a loose o.

"Thank you, Miss Montez," Sam said, and she about-faced and walked out quickly; the door closed behind her with one darting flip of her fingertips. "And at the other end of the spectrum, the fine silver of sophisticated experience." Sam touched the cabinet controls. A sketch materialized in the air, facing Smart. It was a deceptively loose artist's rendering, life-size, of a whipcordy-slim man

with delicate limbs and waving, glossy white hair struck with contrasting pewter-colored lowlights. The expression of the aristocratic face suggested certain things.

Smart nodded reservedly. "Yes. All right. Looks all right. Who's going to play it? Something familiar about him. Who was your artist using for a model? Dusty Haverman?" Smart grinned.

Sam did not. He simply kept looking steadily at Smart, whose eyes first narrowed, then enlarged. "You're kidding! You're—How do we do *Warbirds* without him?—Jesus—" He slapped his thigh. "Perfect! It's perfect! It's a stroke, Sam, a fuckin' stroke!"

"Sure," Sam said.

The back of the meeting was broken. It was all a big long happy glide thereafter. Sar'n Major Mac would come to the fore as the real manager of low squadron, and Private Parkins would play up raffishly. Major Harding's part would be padded a little, and Father Collins would listen to his troubles as he thrashed about trying to assert himself and spoil MacBanion's schemes. At its own expense, as an additional contribution to the relief of the crisis, Ticonderoga Studios would go back into the existing unshown episodes and re-edit to the new slant, so the Gelvarry character would be free to Go West, grow up, and change shows immediately. Sam had some experimental footage, it seemed, which might fit some of that.

In return, GTV would guarantee

renewal next year. About next year—Sam's latest idea was to move on to dirigible-launched P6E's against Fiat CR32 biplanes; he held up the glittering model of the 220-mph fighter, which had not gone out of use until 1938. They would be launched from the *Graf Zeppelin*, which had been Nazi Germany's sole aircraft carrier. Named for the man who pioneered practical lighter-than-air flight.

Smart considered the possibilities and the twists. "Cute," he admitted. "I like it." He shook his head. "I don't know where you get your ideas, Sam. Christ. Planes that sound like cars comin' off a ship that sounds like a dirigible, and what do they run up against? Damn! Yeah—let me see some footage pretty soon, will you?"

Sam had some, it seemed, which would fit some of that. They'd be able to show a rough cut in about a week.

"How about the new show? How soon can I have that?"

Well, it took a little while to get the actors into the milieu. Smart could understand that.

Yes, he could. But—

Oh, they'd push it. Tell you what; how about a progress report in ten days?

Well, if that meant they were close to delivery on the pilot episode.

Right. The *pilot* episode.

Everybody suddenly laughed, and Sam promised to send the little models over to Smart's office right away, for the shelves over the bar.

Smart punched off, and everybody in Sam's conference room began to grin and make enthusiastic quips. They were a high-morale outfit. It almost reminded Haverman of—Well, it should, shouldn't it? Art mirrors life.

Haverman got up from his inconspicuous seat and went over to Sam. "I thought it went very well."

Hal raised an eyebrow. "Well, hello!" he said.

Sam smiled reassuringly. "You heard the man, Duster," he said. "GTV's buying it, and they'll protect us. So it's all right." His eyes said: *I told you I'd take care of you.*

"I'm sure of that," Haverman said with conviction. "It's a Ticonderoga production," and everyone within earshot smiled.

"Why don't we get started?" Sam said and, putting an arm around his shoulders, walked with him out through the door to the technical spaces, which in this area were half-partitioned workrooms and offices grouped-up to either side of the long central aisle that ran back toward the sound stages. Overhead were the whitewashed skylights and the zigzag trusses of the broad, arching roof, and to either side of them were the sounds of word-processing machines and footage splicers. They walked along to a side aisle, and there Sam had to leave him, after opening and holding open for him the heavy wood-grained door marked ACTORS AND MEDICAL PERSONNEL ONLY.

A bright-looking young medical person leafed through his printout. "Dusty Haverman," he said wonder-

ingly. "I never knew you'd been an accounting student."

"Isn't Doctor Virag going to do me? Doctor Virag and I know each other very well," he said, sitting stiffly in his chair.

The medical person did his best to smile disarmingly. "Doctor Virag is no longer with us, I'm afraid. Time passes, you know. I'm Doctor Harcourt; I think you'll find me competent. Sam personally asked me to take you."

"Oh. Well, I didn't mean to imply—"

"That's all right, Mr. Haverman. Now, if you'll just relax, Miss Tauchnitz will begin removing that hairpiece and so forth." Harcourt's fingers danced over keys, and he peered at the screen beside his chair. "Let me refresh myself on this—yes, well, I think you may find it a relief to wear your own hair, for one thing; we'll just bleach it up a little bit. And we'll tan you. That'll be better than that tarty pinky-cheeks tinting, don't you think? Other than that, there's just a *tiny* bit of incising to do . . . a touch of a lift to one eyebrow, and that'll have the desired effect, I'm sure. Oh, yes, the cosmetology here is minimal, minimal. Which is just as well, since we do have a rather thick book of response-adjustments to perform, but then, none of us is perfect for our role in life, really. Or is it 'are perfect'? Would you happen to know which it is, Miss Tauchnitz?"

When they had that done, they walked him down the corridors, past the rows of costume mannequins, and to the processing room, which was hung in soft black nonreflecting fabric, and where they had symphonic control of the lighting. They put him in the chair with the trick armrests and the neck brace.

"This is wine, Mr. Haverman," and he peered aside at the rollaway table with the clear decanter of rosy clarity, and the goblet. As long as he moved his arm smoothly and no more quickly than was gracious he could reach out and take it, and sip. "That's right. Have some more," the pleasant voice behind him said, and when he had had some more, they showed him a holo of Miss Montez and stimulated an electrode.

"Ah! Ah-ah-ah!"

"A little more wine, Mr. Haverman." And again the Montez and the incredible sensation beside which all past experience paled.

To see her come fully lighted out of the featureless soft warm darkness, and to feel what he could feel when she did that, he had only to reach out and take more wine. There was no thought in him of a spastic attempt to pluck something from his skull.

"Shouldn't you be feeding me oysters or Vitamin E? Perhaps some Tiger's Milk?" he jested once after they had stopped the wine and given him some Hennessey to refresh him. The pleasant voice murmured a throaty chuckle behind him.

When there was no further response to his gambit, he said: "Ah, well, I've

really always been a steak and potatoes man, actually," and carelessly reached around to circle his hand into the unknown space behind him, but the pleasant voice said: "More wine, Mr. Gelvarry," and an unnoticeable hand put the goblet into his fingers. "Good enough," Gelvarry said. "Ah! Yes, yes, good enough, I say."

They showed him a slim, freckled woman with prominent front teeth, dressed in a calf-length skirt and a cardigan sweater over a cotton blouse. She wore soft leather street boots over dark lisle stockings, and moved like something wary in a strange part of the forest. They wiped, and went to a reprocessed, tinted, computer-animated photo of the famous person this was supposed to represent, and when he sipped the wine, they gave him the pleasure effect. Soon enough in the process he found it difficult to distinguish between the photo and the actress in her costume, no matter how the costume changed per reveal, for they always had a fresh photo after each wipe-and-switch, and the costume had clearly been cued by something in the photo, as much as chiffon can be patterned to remind one of gingham. In truth, in a while, he could not distinguish at all, and he found that although after a while they didn't wipe the actress, he had to concentrate very hard to make her out behind the features he now saw for her. So they gave him more wine, and the idea of concentrating was, to his relief, lost.

They did roughly the same thing with the identity of the purposeful young man with the angelic eyes.

And it was done.

"It's good, Sam," Haverman said, sitting in the office with the Hennessey.

"Sure," Sam said.

"I feel it. I feel absolutely certain." He ran a hand along the silvery waves at the side of his head, and touched one finger to his pencil moustache. His hand was lean and browned by the suns of expensive resorts. A chased gold ring set with a ruby glittered on his little finger. "The way you can make me see the guests, instead of the actors playing them—"

"Yeah, well, they aren't actually playing them, you know. We've got this computer tied into the cameras, and when those people move around, the image data gets put through and modified by this fancy program I had the fellows work up. It's pretty good; probably get better. As long as the players don't do anything grossly out of character, the computer can edit the image to fit the model character. That's what goes on the air."

"But how do I see it, playing with them?"

"Well, you can't, Duster, that's why we do that hocus-pocus in the darkroom. One of the hocus-pocuses." Sam patted him lightly at the neck. "Saves you having to act, you know, old Duster." He was sitting beside him on the couch, and leaned forward to cap the Hennessey.

"I think I could act it," Haverman said very softly.

Sam sighed. "Well, perhaps you

could. But you see, this way it all goes smoothly and very naturally, don't you see? No lines to remember, no breaks for lunch— But those are all technical details, Dus, and there's absolutely no need for you to learn them."

"Still and all," Haverman said. "Still and all." Sam was uncapping the wine now. "I think you're very inventive," Haverman hastened. "That was always true of you. Do you know what I think? I think your next computer program will make it completely unnecessary to have anyone walking around for the cameras to focus on. Sam, that's true, isn't it? That's what you'd really, really like, isn't it?"

"Why, that's not true at all," Sam almost said; Haverman strained to hear him say that, and it seemed to him he was saying it, just outside the range of human hearing. He peered, and he craned his neck. But Sam was saying: "It's almost studio time, Dus. Have some wine," in his pleasant voice.

Haverman sighed. "Oh all right, if that's the best you can do."

"My name is Austin Gelvarry," he repeated to Miss Montez, who was probably staring over his shoulder at the glistening, intricately decorated brass bed. "I have the power to call up whatever pleases me." He sipped from his glass, as she was doing. A nice light was developing in her eyes.

"I—seem to remember something different—"

"Have some more wine. It does no harm. It's strong drink that is raging," Gelvarry said, preoccupied, watching the little monkey plucking fruit from the bowl on the sideboard. The monkey caught his eye and winked.

"Listen," Miss Montez said, "it's just you can't find a secretary job anywhere anymore," but she was sipping.

Gelvarry smiled. Beyond her a Lockheed Electra was just touching down, crabbing a little in the wind as one might very well expect of so small an aircraft, even if it were an all-metal cabin twin. She settled in nicely, with just a spurt of blue smoke at the tires, and began to run out. He watched the pilot swing the Electra around deftly, and begin taxiing toward them.

"Do I please you, Austin?" Miss Montez said over the rim of her glass, looking at him through her lashes. She seemed quite nicely settled-in now.

"Ah," Gelvarry said. "Ah." The Electra came to a halt and the cabin door popped open. A slim figure jumped down and waved, and began running toward them. "Here's Amelia!" Gelvarry exclaimed gladly.

A Ryan high-wing monoplane, lacking the reflection of sun on windscreen glass, came over low, light glittering at its engine-turned cowling. A figure waved down from a side window, and then the *Spirit of St. Louis* banked away to line up upwind, flaring out for its landing, its prominent wheels seeming to reach down for the ground against the red outline of the evening sun. Gelvarry and Miss Montez both half-rose with pleasure. "And here's Lucky Lindy now!" ■

20 years of fusion

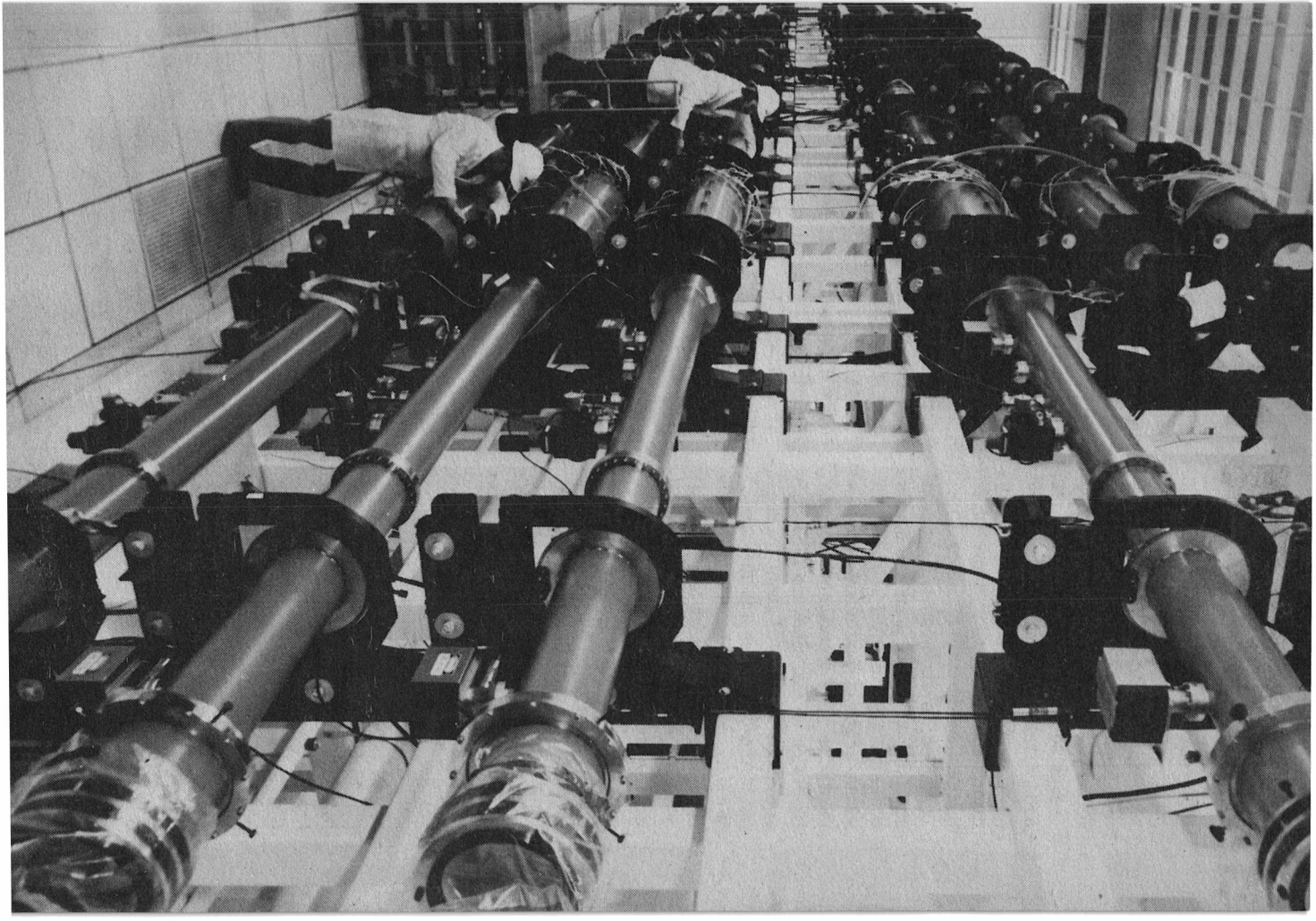
What is past is prologue—what's coming is fusion power!

Milton A. Rothman

Somewhat breathtaking is the realization that twenty years have passed since my first article on thermonuclear fusion appeared in the September, 1957 issue of Astounding. During that time I have spent ten of my own years working in the experimental end of fusion research, have watched it grow from a modest effort involving a small group of creative physicists struggling with a new idea, into a giant international program in which a single research contract can involve hundreds of millions of dollars.

In 1958, the fusion research programs of the United States, England, and the USSR, newly released from secrecy, were displayed to the world at the historic "Atoms for Peace" conference held in Geneva under the auspices of the International Atomic Energy Agency. A glance back to that conference provides a startling reminder of the differences in conditions and attitudes that have come about during the elapsed time. In 1958 an air of optimism and naivete allowed famous men to predict that the thermonuclear fusion problem would be solved in twenty years. Now, in 1978,

A photograph of a portion of Shiva, the 20-arm laser fusion device, just completed at the Lawrence Livermore Laboratory.



those who remain optimistic are still pointing twenty years into the future. Apparently twenty years is a nice, safe time for predictions—short enough to be in the foreseeable future, but long enough so that if you miss the mark nobody will remember. However, we do feel that the predictions being made today are based on more information than those made earlier.

Those of us who wrote and lectured about fusion twenty years ago have a continual urge to say *I told you so* whenever the current energy crisis is mentioned. The arguments we made for fusion at that time are the same arguments which swirl about the center of the current energy discussion. We were experts at drawing curves of increasing energy use while supplies of oil were quickly coming to an end. We were aware of difficulties with fission reactors, especially the breeder reactor, so that the almost infinite supply of deuterium fuel in the oceans captured our imaginations and made it seem worth spending a great deal of money and effort to make this fuel usable as a source of electrical energy.

The fusion program had begun in secret, shortly after development of the hydrogen bomb, in 1950. The futility of secrecy in this case soon became apparent when it was found that simultaneous programs were going on in Russia, England, and the United States—the latter under the code name Project Sherwood.

The theoretical aims of the fusion program were quickly set out. The nuclear reactions feasible for a controlled thermonuclear reaction involved the two isotopes of hydrogen: deuterium (D) and tritium (T). Each of the following four reactions involves the fusing of two lighter atomic nuclei to form a heavier nucleus and a lighter particle—either a neutron or a proton. The nucleus and the particle fly apart, each with an amount of energy shown in parenthesis (in units of millions of electron-volts).

$D + D \longrightarrow He^3$ (0.82 MeV) + n (2.45 MeV)

$D + D \longrightarrow T$ (1.01 MeV) + p (3.02 MeV)

$D + T \longrightarrow He^4$ (3.5 MeV) + n (14.1 MeV)

$D + He^3 \longrightarrow He^4$ (3.6 MeV) + p (14.7 MeV)

The energy values can be appreciated by realizing that a single liter of water would give you the same amount of energy (from the D-D reaction) as the burning of 300 liters of gasoline. (Even though only 0.015% of the hydrogen in the water consists of deuterium isotope.)

From the theoretical point of view, all that is needed to make these nice reactions go is to take a container of deuterium and heat it to a very high temperature. At such temperatures the atomic nuclei have their electrons stripped away, and the bare nuclei bang around at very high speeds, colliding with each other frequently. Some of these collisions end up with two nuclei sticking together, and the result is a fusion reaction. With millions of fusion reactions taking place

within the container, the energy emitted can be collected, converted into heat, and used to operate steam turbines.

When you start putting numbers into the equations and asking how high a temperature is needed to make the reactions go, a serious problem raises its ugly head. Since the colliding nuclei are both positively charged, there is an electrical repulsion between them. This means that they have to be traveling with considerable speed before they can get close enough to fuse. To get such speeds you need rather high temperatures.

How high? Now we have to start talking in terms of hundreds of millions of degrees (and whether you call it Celsius or Kelvin doesn't make much difference). At this temperature a gas is not just a gas. All the electrons have been stripped from their atoms, the gas is completely ionized, and what you have is a *plasma*—a fluid consisting of positive and negative charges floating about. A fluid with properties much more complex than any fluid previously known in science.

Since a plasma is what you get as soon as you try to achieve thermonuclear fusion experimentally, the study of plasma physics is the basis of fusion research. When I entered the fusion program in 1958, nobody had ever taken a course in plasma physics. It was a brand new specialty. To find out what it was about, we went to lectures given by the people who were actively working out the theory of this subject. At that time theory and experiment rarely agreed, because the theory was so complex, and any equations you wrote down had to be wild approximations to the truth. Now the field has matured to some extent, the universities grind out PhDs with specialties in plasma physics, the advent of fast computers has made it possible to do calculations undreamed of twenty years ago, and theory and experiment begin to come together. Thus, in one generation we have seen the development of an entire branch of physics, with ramifications that spread far and wide. A good deal of astrophysics is now plasma physics, since almost all of the matter in the universe is in the plasma state.

During the past twenty years, the theories about what conditions are needed to create a self-sustained thermonuclear fusion reaction have gone through some refinement, but have not changed basically. It is still recognized that two fundamental conditions are needed. First, the plasma must be heated to a high enough temperature so that it reaches "ignition" (in the nuclear sense) and forms a reaction that can keep itself going. But more than high temperature is required. It is also necessary for the plasma to be dense enough and for the plasma to stay in one piece long enough for this self-sustained "burning" to take place.

The reason for this comes from the fact that the deuterons within the container of plasma are dashing madly around, and you can see that they are

very, very quickly going to hit the walls of the container and lose their energy long before they have a chance to react and produce more energy. Clearly, what you need is a way of preventing the plasma from touching the material walls of the container—to keep it suspended in the center of the chamber while the deuterons have time to collide with each other and fuse.

This is the problem of *confinement*, and the length of time the plasma particles can be held without touching the walls is called the *confinement time* of the device. By far the greatest effort in fusion research has gone into learning ways to confine the hot plasma for as long a time as possible. The question is: how much confinement time is necessary?

The answer to this question depends on a number of factors, but as a crude rule of thumb the result can be stated in the following way—the so-called Lawson criterion: If we multiply the confinement time (for a plasma in a given device) by the plasma density (the number of particles per cubic centimeter), we get a number that we call the Lawson number. For a fusion reaction to be self-sustaining, this Lawson number must be greater than a certain value, which depends to some extent on the plasma temperature, and depends to a great extent on which fusion reaction you are talking about.

Let's see how this theory applies to the D-D reaction. First we find that a very high ignition temperature is required—about 400 million degrees K. Such a high temperature is almost meaningless to contemplate. In order to make sense out of it we must keep in mind the fact that in much of what follows we will be dealing with gases at very low densities—quite a good vacuum, in fact. It's not like we're trying to handle a piece of the Sun in the laboratory. It's more like trying to capture some of the Sun's corona.

Usually plasma physicists don't think of temperature in degrees, but rather think of the average energy of the plasma particles in electron-volts. One eV is about equal to 10,000 degrees Kelvin, so that the ignition temperature for the D-D reaction turns out to be 40,000 eV (40 keV). Whatever units you use, that's an extremely high temperature. Immedi-

ately it becomes a fearsome hurdle to the success of the enterprise.

Matters become even worse when we ask what kind of confinement time the Lawson criterion predicts. Grinding the numbers through the equations, we find that for the D-D reaction the Lawson number must be about 10^{16} sec cm^{-3}. This means that if you have a plasma with a density of 10^{15} particles per cubic centimeter, the plasma must be confined without spreading to the container walls for about 10 seconds.

These numbers represent conditions that are extremely difficult to accomplish in practice, and are a factor of 1000 greater than anything that has been attained so far. If we were limited to the D-D reaction, we might not be so optimistic about prospects for the future. However, the situation is saved by the possibility of using the D-T reaction, which goes much more easily than the D-D reaction. A mere 5 keV (50 million degrees) is needed for ignition, and the Lawson number is about 10^{14}, making it about 100 times easier to attain burning with D-T than with D-D.

The only hitch here is that tritium is not found in nature, at least not in any useful quantities. It is a radioactive element, with a half-life of twelve years, so it's not going to hang around to be picked up out of the ocean. You have to manufacture it. For this purpose the useful reactions are:

$$Li^6 + n \longrightarrow T + He^4$$

$$Li^7 + n \longrightarrow T + He^4 + n.$$

The breeding of tritium from lithium, using neutrons from fission reactors, is already standard procedure. This tritium will be the fuel for the startup of fusion reactors. Once these fusion reactors are in operation, they will be surrounded by blankets of lithium compounds for the purpose of breeding more tritium fuel by the absorption of the neutrons produced in the reactors.

You notice that in the D-T system it is actually the lithium that is the primary fuel source. This means that as long as we are limited to the D-T reaction, our supply of fuel will depend on available supplies of lithium, which are not exactly "inexhaustible." (Note: If it appears that fusion is about to succeed, start buying stock in suppliers of lithium.)

The scenario for fusion power during the next century, then, visualizes D-T reactors beginning to produce power during the first quarter of the 21st century. In the meantime, research continues into ways of attaining higher plasma temperatures and longer confinement times, so that eventually—perhaps in the 22nd century—the D-D reaction will be the ultimate solution to the energy problem for uses where large amounts of electrical power are required in concentrated form. It is estimated that the amount of deuterium in the ocean would supply us with energy at the present rate of use for about ten million years.

To reach these goals will require the most advanced accomplishments of physics and engineering. The technical problems involved in the heating

and confining of a thermonuclear plasma are among the most difficult that have ever been tackled. To understand some of these problems, let us take a look at some of the things that were known about fusion twenty years ago and compare then with what we know now. When you look at the progress that has been made you can see why people in the program who have had the fortitude to stick it out still believe that fusion power will eventually take the place of fission power.

When I entered the program in 1958, the prevailing idea was that a plasma could be confined by a magnetic field of suitable shape. Several shapes were considered; mainly there were linear devices and there were toroidal devices, each of which had its own virtues and vices. The basic idea was that if you put a hot plasma in a strong magnetic field, the electrically charged particles of the plasma would tend to spiral around the magnetic lines of force. They could still travel along the lines of force, so that if you used a straight magnetic field, the particles would go straight into the container walls at the two ends. (Fig. 1) However, if you made the magnetic field stronger at the two ends than in the middle, a fraction of the particles would be reflected back toward the middle and most of the plasma would be confined. This type of magnetic field is, for obvious reasons, called a "magnetic mirror." (Fig. 2)

Another scheme for keeping the plasma from flying out the ends of the magnetic field was simply to eliminate

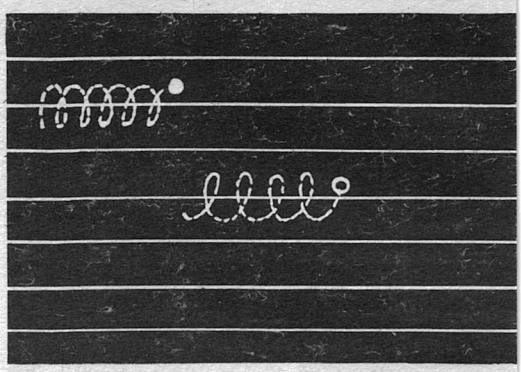


Figure 1. Electrically charged particles in a magnetic field move in helical paths, so that they may travel along the magnetic lines of force, but not across them.

the ends by curving the field into a closed loop, so that the plasma assumed the shape of a doughnut—more technically known as a torus. This concept gave rise to an entire family of toroidal devices among which the stellarator and the tokamak have been the most prominent.

It was recognized very early in the game that a plasma does not take kindly to being confined in a curved magnetic field. The negative electrons and positive ions drift in opposite directions at right angles to the magnetic lines of force, giving rise to electric fields that very quickly blow the entire plasma out of the container. This type of behavior is but one of many kinds of instabilities that interfere with the confinement of plasma in magnetic fields. A major effort of these last twenty years has been to solve the instability problem mathe-

matically, and to devise practical ways of overcoming instabilities in real plasmas.

You can get an idea of what this problem is about if you think of a container half-filled with water. Normally you think of the water as being on the bottom. That's the state of stable equilibrium. However, suppose you turn the container upside down so that the water is on top, and furthermore, suppose that the air pressure is great enough to support the weight of the water. Will the water stay on top?

A simple-minded calculation informs us that this system is, indeed, in a state of equilibrium. Yet our instincts tell us that something is unnatural about this sitaution. In fact, if we make the mathematics a little more sophisticated, we find that this is a state of *unstable* equilibrium and will come crashing down under the slightest provocations.

Trying to confine a hot plasma in a magnetic field is a very similar kind of situation. It's like trying to hold a blob of jello in a fish net. It quivers and shakes and keeps escaping through the holes. In addition to the large-scale hydrodynamic instabilities there are a number of micro-instabilities characterized by high frequency oscillations in the plasma.

As a result of these instabilities, a plasma tends to escape from the magnetic container much faster than it would by normal gaseous diffusion. Remember that we would like to keep the plasma confined for about one second. If we tried to confine a plasma in a doughnut-shaped container with nothing but a toroidal magnetic field,

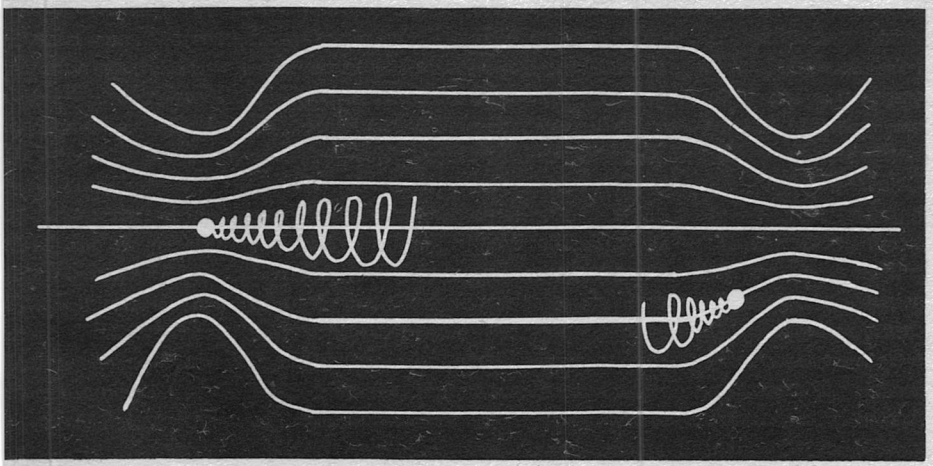


Figure 2. In a magnetic mirror the magnetic field is stronger at the two ends than in the middle. As a result, the charged particles tend to be reflected back toward the center of the mirror.

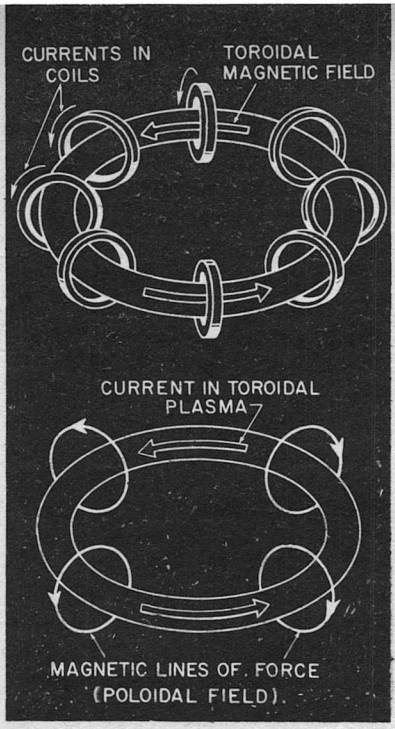


Figure 3. The tokamak confines the plasma in a toroidal magnetic field produced by electric currents running in a number of confining field coils. A large electric current running around the toroidal plasma produces a "poloidal" magnetic field whose lines of force make circles around the plasma. The combination of the toroidal and poloidal fields is a magnetic field that goes around the torus with its lines of force twisting like the stripes on a barber pole.

it would escape to the walls in just a few microseconds. It was recognized very early in the game that to stabilize the plasma against this kind of explosive escape you had to put a twist into the magnetic lines of force. If you visualize bending a barber pole into a doughnut, the stripes on the pole would plot out the shape of the magnetic lines of force.

This concept resulted in the invention of the stellarator by Lyman Spitzer, the first director of the Princeton Plasma Physics Laboratory. The original idea had the torus twisted into a figure-eight, but soon it was realized that you could get the required twist in the lines of force by using special twisted coils to produce the magnetic field.

With the help of this twisted field, the early stellarators had confinement times of up to 2 milliseconds (two thousandths of a second). The plasma was escaping 50 times faster than desired. Even with this rapid loss of plasma it was found possible to heat the plasma to respectably high temperatures. In one experiment I engaged in, using the ion-cyclotron resonance heating method designed by Tom Stix, we were able to raise the ions in the stellarator to the very respectable temperature of 5 million degrees K (500 eV), while in localized "hot spots" the temperature got as high as 2000 eV. To obtain this result we had to pour a few hundred kilowatts of radio-frequency power into the plasma.

It was clear that we had effective

heating methods, but that the plasma did not hang around long enough to get as hot as we would like. It was like trying to fill a bathtub with an open drain. It was also clear that to reach higher temperatures, longer confinement times were needed.

A clue to the longer confinement times came from Russia. Late in the 1950s and through the 1960s we began to hear of a device called the tokamak, developed under the leadership of Lev Artsimovich at the Kurchatov Institute in Moscow. (The name is an acronym for TOroidal KAmera MAKnetic—or toroidal magnetic chamber.) The tokamak, like the stellarator, uses a toroidal magnetic field, but unlike the stellarator the twist in the magnetic field is produced by huge electric currents going around the plasma itself—currents as large as a million amps. (Fig. 3) (These currents are induced in the plasma by treating it as the secondary coil of a transformer.) The key to making the tokamak work is the large cross-sectional area of the plasma, allowing great electric currents to run through it without producing turbulences and instabilities.

Because of this large plasma cross-section, tokamaks tend to have big, fat, doughnut-shaped vacuum vessels. The largest tokamak built to date, the Princeton Large Torus (PLT), has a plasma nearly one meter in diameter, curved around in a torus 2.6 meters in diameter. (Fig. 4) Experiments performed during the 1960s and 70s have shown a steady progression toward longer confinement times and higher temperatures. In the Princeton Large Torus confinement times of 50 milliseconds and temperatures of 1 to 3 keV, at a density of 2×10^{14} electrons per cm^3, bring us to a Lawson number of 10^{13}, only a factor of 10 less than the

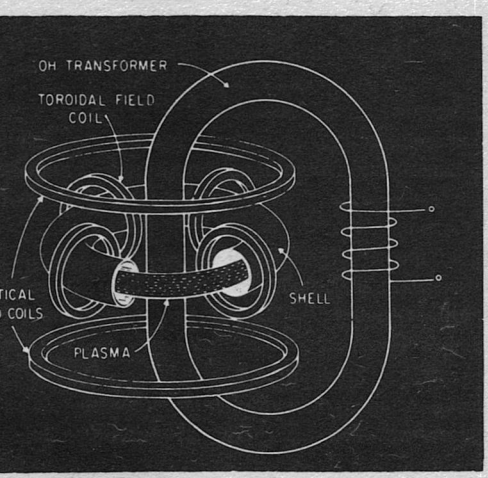


Figure 4. A highly schematic drawing of a tokamak, showing the vacuum vessel, the confining (toroidal) field coils, the vertical field coils used for positioning and stabilizing the plasma, and the ohmic heating (OH) transformer used to induce the electric current in the plasma. Russian tokamaks use iron core transformers, while Princeton tokamaks now use air core transformers.

number needed for a self-sustained reaction.

It is this continual improvement in performance, year after year, with the building of larger and more sophisticated devices, that has convinced the fusion research community that the goal of a fusion power generator can be reached. The purpose of building bigger machines is not just to spend more money, even though that is one of the practical effects. But the fundamental theory of the process—now verified by many experiments—assures us that there are two basic ways to slow down the loss of plasma and increase its confinement time. One is to increase the volume of the plasma, and the other is to increase the strength of the confining magnetic field.

In the tokamak, both parts of the theory are verified by experiment. Very recently a rather small and modest tokamak named Alcator, built at MIT by Bruno Coppi and Bruce Montgomery, has achieved confinement times of 15 milliseconds in a plasma only 20 cm in diameter, but using a magnetic field of 65 kilogauss magnitude, about twice the field usually employed in these devices.

Since larger plasmas result in longer confinement times, the path toward the future—as far as tokamak research is concerned—is clear. Build bigger machines. This decision results in a sociological process clearly seen developing in the fusion research laboratories during the past two decades. The labs originally were intimate places where the director himself would help wind the magnet coils. As machines got more sophisticated, engineers were brought in to do the design work. Big machine shops and coil-winding shops became an intrinsic part of the laboratories. Physicists found themselves doing the work of engineers, and engineers found themselves doing the work of physicists. Only the theoretical physicists maintained their pure identity.

And of course, as the money from Washington got bigger and bigger, the controls from Washington got tighter and tighter, until the lab was as much an extension of ERDA as it was a part of Princeton University. People who had managed to spend some of their time on fundamental research found themselves more and more restricted to tasks directly channeled toward a specific goal. It took the fun out of things a bit.

But optimism heightened as the tokamak results showed promise and it looked as though the lab was to be catapulted into a different kind of league. The climax came during the summer of 1974. I happened to be in the office of Mel Gottlieb, director of the Princeton Plasma Physics Laboratory, the day the phone call came in from Washington, and I could observe how the lab had adopted the trappings of big business. The phone was connected to the loudspeaker, the research staff was invited into the office, and the voice of the Director of the Fusion Division of ERDA (in Washington) could be heard making the

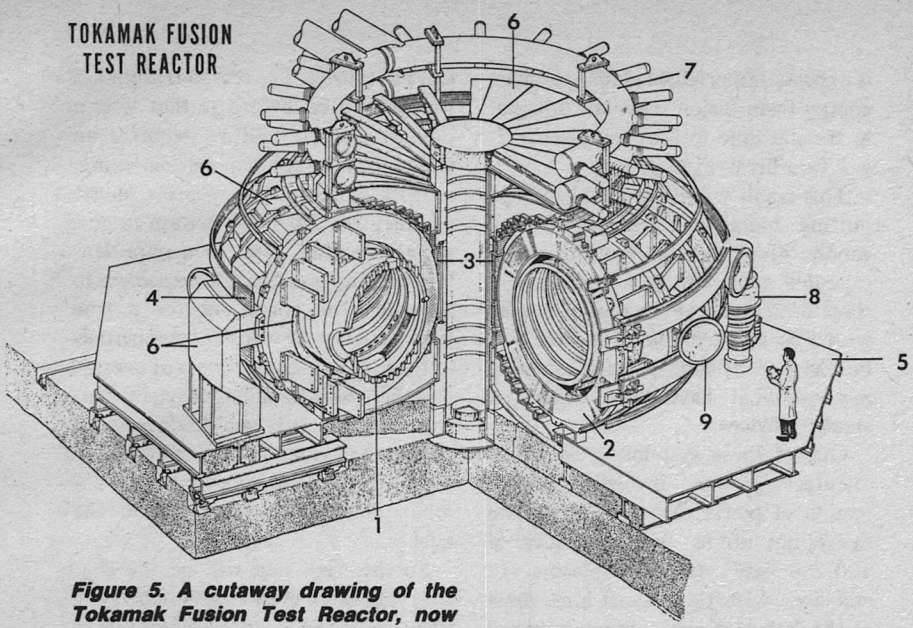


Figure 5. A cutaway drawing of the Tokamak Fusion Test Reactor, now under construction at the Princeton Plasma Physics Laboratory.
1—Vacuum Vessel 2—Toroidal Field Coil 3—Ohmic Heating Field Coil 4—Equilibrium Field Coil 5—Device Substructure 6—Shielding 7—Water Cooling Header 8—Vacuum Pump 9—Neutral Injection Duct

long-awaited announcement that Princeton had been chosen as the site for the construction of the Tokamak Fusion Test Reactor (TFTR), the next in the series of large research tokamaks to be built.

This was a most exciting moment, and not simply because it established Princeton as the leading fusion laboratory in the country. Not simply because of the astronomical amounts of money involved—over $250 million to be spent by 1980. The main excitement was caused by the quantum jump in magnitude of this machine over all previous devices. It is to be twice as big in linear dimensions as the Princeton Large Torus. This means a vacuum vessel over two meters in diameter, with the torus 5.6 meters in diameter. (Fig. 5) A recent Time Magazine photograph (June 6, 1977) shows the lab director standing upright within the vacuum vessel of the TFTR. And Mel Gottlieb stands well over six feet tall. (The 2-inch pipe held in his hands is part of the vacuum vessel of the first stellarator.)

As a direct result of this enormous increase in size, the TFTR will be almost a fusion reactor. In actuality, it will be a model designed to demonstrate the feasibility of the tokamak concept as a fusion reactor. That is, it

is expected to produce almost as much energy from fusion reactions as is put in the machine to heat the plasma. It will be a break-even device.

This result will be accomplished by putting together a number of advances. First, the scaling up in size is expected to result in a confinement time of about one second. Coupled with this long confinement time will be the use of high-powered heating methods that have been tested on smaller devices.

One of these systems is known as "neutral injection," involving the projection of powerful beams of neutral deuterium atoms (with energies of 100-200 keV) into the plasma. In collisions with the plasma ions, most of the fast deuterium atoms exchange electrons with the slower deuterium ions of the plasma. The fast atoms become ionized and are thus trapped in the magnetic field, raising the energy of the plasma.

Another heating scheme involves the irradiation of the plasma with high powered electromagnetic waves. Various types of resonances, such as ion cyclotron resonance or lower-hybrid resonance, may be used to couple the wave energy strongly to the ion motion in the plasma. (For a fictionalized version of the competition between neutral beam heating and RF heating, see my story "Fusion," in *Stellar-1*, Ballantine, 1974.)

In addition to better heating and confinement, the new machine will introduce tritium into the plasma, so that the benefits of the D-T reaction can be realized. The reason tritium has not been used before is that it is a radioactive gas, and so requires an elaborate system for its safe handling.

With higher temperatures, longer confinement time, and tritium to give greater reaction rates than pure deuterium, the machine is expected to approach the conditions for a true fusion reactor. It will, for brief periods of time, emit large amounts of energy, together with copious blasts of neutrons. It will still not produce more energy than is put into it, but it will—if all goes well—demonstrate that another increase in size will do the trick.

So the next step will be the construction of an even larger model, one that would be a true self-sustained reactor. That device would not be completed until the 1990s.

It is completely fascinating to study the planning documents of the Fusion Division of ERDA, with its flowcharts, its decision points, its timetables. To speak now of building a fusion reactor in 1990 sounds like science fiction. But this is the schedule—assuming that all goes as planned experimentally, and that Congress appropriates the money.

Mirrors

While half the U.S. fusion budget is going into tokamaks, there are many roads to fusion. Three schemes now lead the field, and it would be a very intrepid speculator who would predict which one of them is going to win out in the end. Periodically an idea that

sounded good at the beginning gradually dies out as it is proven infeasible. One of the earliest proposed ideas—the pinch effect—was one of the earliest given up because of its inherent instability.

Another of the earliest ideas, the magnetic mirror, has gone through a number of stages in evolution, but is still going strong. Early mirror confinement was plagued by hydrodynamic instabilities that quickly threw the plasma out of the magnetic field. During the 1960s it was found that good stabilization could be produced by shaping the magnetic field in a certain way—namely by making the magnetic field strength a minimum in the center of the plasma and increasing it in all directions outward—the equivalent of a potential well. (Fig. 6) This scheme was first realized in practice by the Russian physicist M.S. Ioffe, whose "Ioffe bars" made a dramatic improvement in the operation of magnetic mirrors.

In the United States, much of the work on mirrors has been done at the Lawrence Livermore Laboratory, near San Francisco. A device called 2XIIB has recently obtained results rivaling that of the tokamak. Using neutral injection techniques, they have produced a plasma with an ion energy of 13 keV, and a Lawson number of almost 10^{11}, a factor of 1000 less than the final target goal. The Lawrence Livermore Laboratory is now proposing a larger machine, to cost about $100 million, raising the Lawson number to 10^{12} and making it comparable in performance to the Princeton TFTR.

Inertial Confinement

While two types of magnetic confinement are in competition for the prize, another contender has gotten into the race during the past decade, making use of an entirely different approach. In magnetic confinement, the aim is to make the confinement time as long as possible, while working

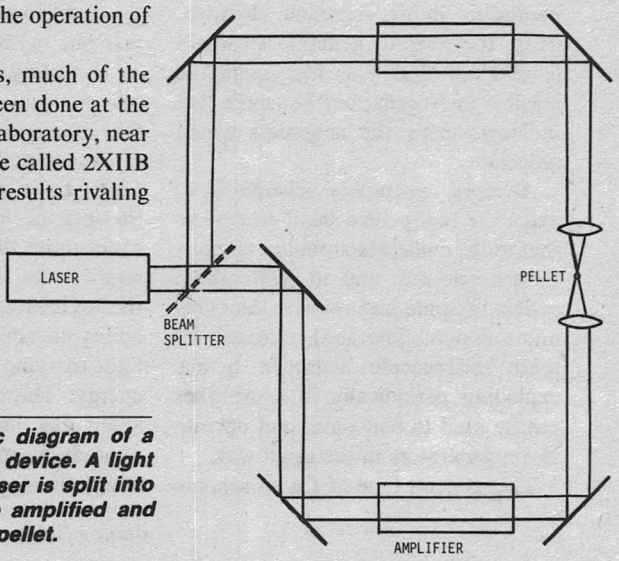


Figure 6. A schematic diagram of a two-beam laser fusion device. A light beam from a single laser is split into two beams which are amplified and focused onto a fusion pellet.

with plasmas of fairly low density. (The density has to be kept to about 1/100,000th of an atmosphere, or else the energy released by the fusion reactions will be more than the materials of the reactor can handle.)

But suppose you take the opposite tack. What if you don't try to confine the plasma at all, but simply depend on its inertia to keep it from flying apart for a short time after it is heated? Provided it is dense enough, there will be a healthy energy output even if the plasma sticks together for only a billionth of a second. That, in fact, is how a hydrogen bomb works. A quantity of D-T mixture is heated by a uranium bomb, and in the fraction of a microsecond before it flies apart, the fusion fuel ignites.

While it might seem that an H-bomb would release too much energy to handle at one time, there have been serious proposals to explode small bombs in an underground chamber, using the heat to generate steam in large quantities. This idea might be feasible in Nevada, but I suspect that in New Jersey the neighbors would object.

A more acceptable scheme is to make the fuel pellets small enough so that quite moderate amounts of energy are released, and to ignite these pellets by some means other than uranium fission. The heat released by these microscopic hydrogen bombs exploding periodically in a chamber can be used to boil water and operate steam generators in the usual way.

This general type of fusion scheme goes under the name of *inertial confinement*, because, as mentioned before, it is the inertia of the plasma that holds it together for the fraction of a microsecond needed for the fuel to "burn." If, for example, a pellet of solid D-T mixture is heated, we obtain a plasma with a density of 5×10^{22} ions per cm^3. Then the Lawson criterion tells us that we need a confinement time of only 2×10^{-9} seconds—just 2 nanoseconds—to allow the completion of the reaction.

Of course this means that the pellets must be heated to ignition temperature in this incredibly small time. This, in turn, means that many joules of energy must be concentrated upon and absorbed by this tiny fuel pellet in a time one-thousandth that required to paint a single dot of light on the screen of your TV receiver. The emission of energy by the pellet is explosive, and the name of the game is *break-even*—you want to get more energy out than you put in. By periodically shooting off these tiny bombs—say ten times a second—you create a quasi-steady flow of energy.

As soon as the laser was invented (in 1960) there were speculations about the use of high powered lasers to concentrate their electromagnetic energy on the tiny fuel pellets. One of the useful things about lasers is their ability to emit nanosecond pulses of light carrying respectable amounts of energy. However, early calculations about the amount of laser energy needed gave numbers that were frightening in the extreme. It began to

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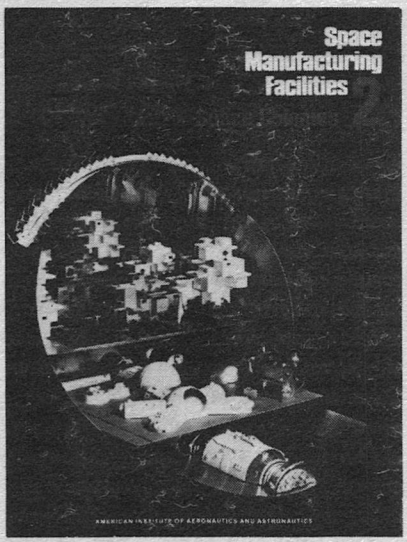

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appear that as much as 10^{10} joules of laser energy would be required to ignite a single pellet. (Recall that a machine operating with a *power* of one watt delivers one joule of *energy* in one second of time. It would take a 1000-Megawatt power plant 10 seconds to generate 10^{10} joules of energy.) When laser fusion was first considered, nobody knew how to get a hundred joule pulse out of a laser, and even today 10,000 joules is considered big business. So in the mid-1960s the entire scheme of laser fusion appeared hopeless just from the size of the numbers involved.

However, in 1972 a new idea got into the public domain—the idea of *imploding* the fuel pellet to a smaller volume and higher density, as a result reducing the required laser energy by a very large factor. The way the implosion principle works is, roughly, as follows: A number of powerful laser beams are focused on a fuel pellet so that it is illuminated uniformly from all directions. The energy absorbed by the D-T pellet heats the outer surface of the pellet very rapidly, so that there is a sudden expansion of this heated, ionized gas. These expanding gases can be thought of as the exhaust of a rocket; the recoil produced by this expanding exhaust presses back uniformly toward the center of the spherical pellet. The recoil pressure is so great that the inner part of the pellet *implodes*, with a great increase of temperature and density. During the implosion the plasma becomes hot enough to start self-sustained thermonuclear reactions going, and an ignition of "burning" front moves in toward the center of the sphere.

A number of detailed calculations of these processes were performed, using the methods of computer modeling. All agreed that power-producing reactors could be ignited if the lasers heating the pellets could be made to deliver an energy of one megajoule in a properly-shaped pulse of less than 1 nanosecond duration. (Note: If one megajoule is the amount of energy delivered in 10^{-9} sec, then the power absorbed is 10^6 joules/10^{-9} sec = 10^{15} joules/sec = 10^{15} watts = 1000 Terawatts.)

Now 1 megajoule is over a thousand times more laser energy than anybody had in 1972, but laser energies have been increasing over the years, and this figure appeared to be a feasible goal. In addition, a great many people in military circles were interested in developing high-powered lasers for a variety of reasons. Therefore the AEC (now ERDA) gave the go-ahead for a research effort in this direction.

While 1972 marks the date the implosion principle hit public awareness, the idea actually had been in private circulation since 1961. When we look into the history of laser fusion, we find a fascinating case-example of the way military secrecy can distort the course of scientific progress.

Ever since the invention of the hydrogen bomb, efforts had been made, under tight security, to seek ways of triggering a hydrogen bomb without the use of uranium, as well as

to make smaller hydrogen bombs. (The newly announced neutron bomb is undoubtedly a result of that research. While the neutron bomb is triggered by uranium, one can guess that the implosion principle is used to allow a smaller bomb, with less uranium.) Less than a year after the invention of the laser in 1960, computer calculations were undertaken by a group headed by Edward Teller at the Lawrence Livermore Laboratory to find out what would happen to tiny D-T pellets if they were hit by intense beams of laser light. These calculations showed that fusion would be feasible if the implosion caused a density increase by a factor of 10,000.

In the late 1960s, the idea was reborn spontaneously in the minds of others outside the classified program. Keith Brueckner, of KMS Fusion, Inc., made claim to having originated the implosion idea. However, upon declassification of the laser fusion program in 1972, it was apparent that the principle had been well-known behind the walls of Livermore for a decade. Thus, the secrecy resulted in an enormous duplication of effort, as well as ill-mannered squabbling over priorities.

The irony of the situation is that when all the smoke cleared away it turned out the Soviets knew all about it anyway. They had bigger lasers than we did, were spending more money on the program, and had reported observations of neutrons produced by a laser-heated plasma at the Lebedev Physics Institute in 1968. Who was the secret being kept from?

In the United States, laser fusion programs are being carried on at the Lawrence Livermore Laboratories, Los Alamos National Laboratory, KMS Fusion, Inc. (Ann Arbor, Michigan), and at the University of Rochester. Until recently, most of the experimental work was being done with neodymium-glass lasers, since these are readily available, and are capable of giving nanosecond pulses of infrared light (1.06 micrometers wavelength) with energies in the range of hundreds of joules. However, there is a limit to the amount of power that glass can handle because of heating problems, so that a good deal of effort has gone into a search for alternative kinds of lasers.

While these new lasers were being developed, pellet heating experiments were proceeding with the Nd-glass lasers, pushing them to their limits, because before anything else could be done it was necessary to verify the calculations that had been ground out on the computers. The theoreticians had tried to put into the calculations all the processes that they thought could happen when an intense beam of electromagnetic energy hits a target, but you never know what unknown interaction might have been left out.

One point agreed upon by all theorists is that in order for the heating to take place uniformly, the fuel pellet must be irradiated more or less evenly from all sides by the laser beam. Thus, any workable scheme must start with a beam of light from a single laser and

then split this beam into a number of separate beams by an optical device known as a beam splitter. (A half-silvered mirror is the most familiar type of beam splitter.) Each beam is now raised to very high power levels by a light amplifier and then focused on the target by means of a converging lens. Starting with a single laser and keeping the flight path equal for all the beams ensures that the single brief pulse of light will hit the target simultaneously from all sides.

(What is a light amplifier? It is a laser without the end mirrors that provide feedback and promote self-oscillation. Its atoms are pumped to excited states by flash lamps, and when a beam of light having the correct wavelength passes through, these excited states are stimulated to emit light of the same wavelength and phase as the original beam. Thus the original beam is amplified.)

Until recently the experiments have been limited to light-beam energies below 1000 joules. This is a factor of a thousand less than that needed for break-even conditions. But even so, the numbers involved are of an order of magnitude beyond anything this physicist has been accustomed to—and are beginning to stretch the metric system set of prefixes to their limits.

Consider 1000 joules of energy striking a sphere 0.02 cm (200 micrometers) in diameter. This energy arrives in a pulse 1 nanosecond (10^{-9} sec) in duration, so that the power delivered during the pulse is 1 Terawatt (10^{12} watts). The power density (the energy flux density) at the surface of the sphere is close to 1000 Terawatts per cm^2 (10^{15} watts/cm^2).

A very fundamental theorem of electromagnetism tells us that the pressure exerted by a beam of light is equal to the energy flux density divided by the speed of light. Putting in the numbers, we find that the pressure exerted by the above beam is about 3×10^6 Newtons per cm^2. One atmosphere is just about 10 Newtons per cm^2, so we find that the radiation pressure of our beam is roughly 3×10^5 atmospheres—300,000 atmospheres! No wonder the pellet has to be irradiated evenly from all sides.

You might think that this pressure alone would be enough to compress the sphere. However, when the heating and ablation takes place, the pressure due to the recoil of the exploding gases becomes truly astronomical—the order of 10^{12} atmospheres. Thus, the conditions within the imploding pellet are very similar in temperature, pressure, and density to the center of the Sun.

Recent experiments have shown that in many aspects there is good agreement between theory and practice. Heating and compression does take place, and neutrons are emitted by the fusion reaction. In a recent experiment performed at Livermore with a two-beam system giving a laser power of 4×10^{12} watts for a pulse time of 27×10^{-12} seconds (27 picoseconds), pictures made with an alpha-particle pinhole camera actually

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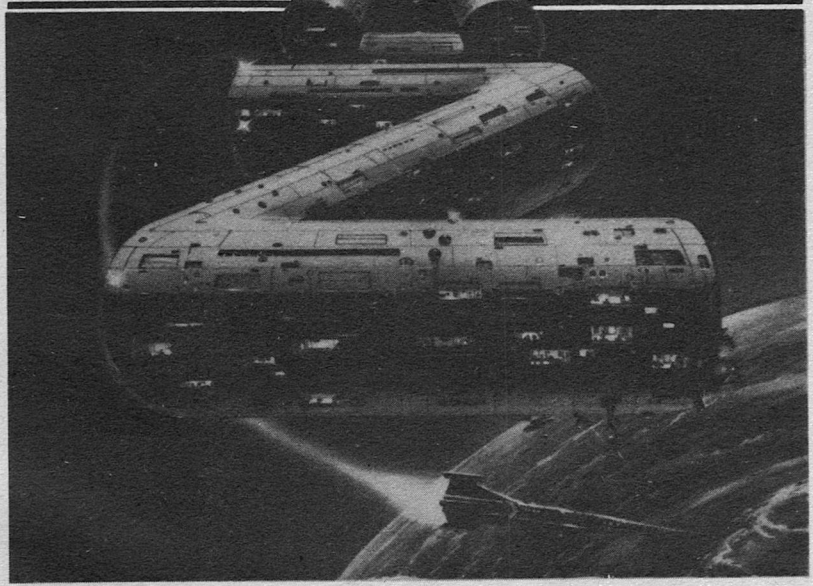

imaged the region in the center of the pellet where nuclear fusion was taking place. About 8 x 10^8 neutrons were yielded by the reaction; an ion temperature of 7 keV and a volume compression factor of 50 were deduced from the results.

For some years a very large device named Shiva has been under construction at the Lawrence Livermore Laboratory. This device consists of 20 arms, producing 20 converging beams, with a total power in the tens of Terawatts. Shiva is expected to go into operation in the fall of 1977, allowing extension of these experiments into higher compression ranges.

In the meantime, however, a completely unexpected development took place early in 1977 at Los Alamos. This discovery overturned quite a bit of conventional theory about laser fusion and made a crucial alteration of the timetable for the development of the high powered lasers needed for fusion—fortunately an alteration in the right direction.

It has long been known that gas-filled lasers are capable of higher power outputs than glass lasers because they can be cooled more readily. In particular, the CO_2 laser has been under development for some years, and units capable of 10 kilojoule outputs are about to come on line.

The one difficulty with the CO_2 laser is that its output is in the far infrared—the wavelength of its light is 10.6 micrometers, compared with the 1.06 micrometers wavelength of the glass laser light. (Visible light has wavelengths between 0.4 and 0.7 micrometers.) All of the theoretical predictions had claimed that the absorption of light by the hot plasma of the exploded fuel pellet depended very strongly on the wavelength—that short wavelengths were much better than long wavelengths. This prediction made the CO_2 laser seem unsuitable as a candidate for laser fusion, and the search went on for new types of exotic gas lasers that would give shorter wavelengths.

However, the people at Los Alamos, who already had an investment in CO_2 lasers, sensibly decided to test the theory by trying out these lasers in a fusion experiment. In an announcement that shook the laser-fusion world in May of 1977, it was revealed that the wavelength did not make as much difference as had been expected. The effectiveness of the CO_2 laser was only down by a factor of 2 compared with the Nd-glass laser, instead of by the theoretical value of 100.

The reason given was that the intense radiation pressure had an effect on the energy absorption which had not been accounted for in the calculations. Regardless of the reason, the immediate result was that the high power and high efficiency of the CO_2 lasers could be used without waiting for the lengthy development of new laser types. This fortuitous result has given laser fusion a very healthy boost toward success.

Within the domain of inertial confinement laser fusion is not without its competitors. One of the characteristic

features of the entire fusion program is that every imaginable approach to the problem is going to be imagined, sooner or later. As soon as the inertial confinement principle was proposed, people began to ask why it was necessary to go the roundabout route of energizing a laser to deliver the energy to the target, when the energy could be delivered in a much more direct manner by hitting the target with a concentrated beam of electrons.

Overall, the electron-beam approach is more energy-efficient than the laser approach, but when we calculate what kind of electron beam is needed to produce a proper fusion reaction, the results catapult us into regimes of power and beam current that have not yet been approached in the laboratory. A theoretical fusion power plant would require electron beams delivering 10^{14} watts of power in 10-nanosecond pulses. If the electrons are accelerated through a million volts, this implies a beam current of 100 million amperes!

An electron accelerator at the Sandia Laboratories in Albuquerque, New Mexico, is able to produce electron beams of 250,000 amps at a million volts for a hundred nanoseconds. Such a beam focused on a 1-millimeter fuel pellet was able to produce an implosion with a compression ratio of 1000, raising the plasma temperature to about 1000 eV.

The technology of creating such massive electron beams is formidable, and a number of problems exist that have not yet been solved. While the electron beam is intrinsically more efficient than the laser, the laser has the advantage that it can be pulsed repeatedly without difficulty. The electron beam devices—essentially high-voltage pulsed cold-cathode discharges—suffer from the fact that the high energy discharges tend to punch holes in the anode. However, methods for extracting the beam are being developed. At Sandia Laboratories a 1 Mev, 200-kiloamp beam of 5 mm radius has been propagated for a distance of 1 meter in air (through a preformed plasma channel).

Following close behind electron beams in the mad scramble for fusion are the various schemes for using proton beams as well as beams of heavy nuclei. Since heavy particles deposit their energy in a target with high efficiency, there are some advantages in using such beams. Consequently an effort is going on to develop high energy, high beam-current, pulsed sources of protons and other particles for fusion work. (Rumors about proton beam weapons abound, but it is hard to visualize a proton beam punching its way in a straight line through the atmosphere for any great distance.)

Makers of high-energy particle accelerators are also beginning to get into the act, pointing out that techniques already standard in accelerator work could be used to build up a high intensity beam of heavy nuclei in a storage ring, to be dumped in a few nanoseconds onto a pellet target. Such proposals have not yet gone

beyond the theory stage, but are beginning to compete for the research dollar.

Fusion research has gotten to the state where mighty big bucks are at stake. A single contract can mean many millions of dollars. Of course, winning such a contract means that the laboratory must now begin to produce results, and life in such a lab becomes a frenetic cycle of activity, filled with enormous stresses of competition.

There are some good results—the things we expect from scientific research—hard work, dedication, the acquisition of knowledge, the occasional excitement of an important discovery—and in the long run, the goal of nuclear fusion energy with its consequences for society as a whole.

There are other results of this frantic competition, results usually visible only to those immersed in the maelstrom. There is a physical and psychological price paid by those working long, hard hours. There are jealousies, clashes of ego, and competition for priority. There are cliques which support one theory over another, one heating method over another, in a manner reminiscent of the enthusiasm of religious cults.

Probably the most common hazard of big research is the proliferation of bullshit. Those in charge of giving out money have to make judgments about what is a good idea and what is not a good idea. With practice they become expert in the detection of bullshit. In the early days of the game they were not always so expert, and many millions of dollars have been spent on ideas which never worked out.

It's easy to second-guess. These expensive ideas all sounded good at the time. But in the early days there was a tendency to charge ahead with costly apparatus before the theory had been sufficiently developed. I have seen enormous pieces of machinery built and then never put to use because at the last minute the theoreticians decided the thing would not work. (And then ten years later they turned around and said that, well, maybe the thing would work after all.)

But don't jump to the conclusion that this was all wasted money and effort. Sometimes it is absolutely necessary to try out a wild idea in order to see it fail. In plasma physics the theory has always been developed in a close interplay with experiment. The theory is so complex that no prediction from theory is worth a nickel unless it has been tested experimentally. It is important to understand this fact.

Why is it necessary to spend such vast sums of money on such a difficult technology in order to solve the energy problem? Why not stick to simpler, "softer" technologies, such as solar energy and coal liquefaction? There is no simple, either-or answer. Solar energy does not provide fuel for transportation unless you go into hydrogen production, and once again you are in the realm of big technology. Coal has environmental and economic problems of its own.

I believe that at this stage in our

civilization it is imperative to press forward with research into energy conversion on all feasible fronts. Each technique has its particular merits and demerits. The time is fast approaching when oil and uranium will not meet the demand for energy in high concentration required by industry. (The dilemma of nuclear power is that without breeders, the supply of useful uranium is quite limited, while the breeder itself breeds more problems than it solves.) It is clear that in the year 2025 fusion energy will be sorely needed. Unfortunately, we can't wait until we need it before we decide to start inventing it.

There has never been another situation in history where we have been required to pursue literally generations of highly intense research on highly technical problems in order to meet one specific need. To do this an entire branch of physics had to be developed.

Fortunately, our government continues to support fusion research at a fairly high level, although there are minor perturbations in a few programs. The fusion research budget for ERDA's fiscal year 1978 contains an overall increase of funds from $246 million to $282 million. Much of this goes into increased research on laser, electron, and ion-beam fusion, as well as into magnetic confinement. However, money was cut from two important construction projects: the Princeton Tokamak Fusion Test Reactor, and Livermore's Mirror Fusion Test Facility. The result of this budget-balancing will be a six-month delay in completing these devices. Also, money was cut from a High Energy Gas-Laser Facility being developed at Los Alamos, but that decision may have been made before the recent promising results from the CO_2 laser.

When you realize that the USSR is spending even more than the United States on fusion, and that healthy programs are in progress in Japan, Germany, France, England, and several other countries, you begin to perceive that the drive for thermonuclear fusion over the world is a very large enterprise, employing thousands of scientists, engineers, and technicians in dozens of laboratories. Even the most pessimistic of these are now speaking of "when" fusion is attained, instead of using the term "if . . ."

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Mikal's Songbird

Some men wield power; some are tools.

Orson Scott Card

The doorknob turned. That would be dinner.

Ansset rolled over on the hard bed, his muscles aching. As always, he tried to ignore the burning feeling of guilt in the pit of his stomach.

But it was not Husk with food on a tray. This time it was the man called Master, though Ansset believed that was not his name. Master was always angry and fearsomely strong, one of the few men who could make Ansset feel and act like the eleven-year-old child his body said he was.

"Get up, Songbird."

Ansset slowly stood. They kept him naked in his prison, and only his pride kept him from turning away from the harsh eyes that looked him up and down. Ansset's cheeks burned with shame that took the place of the guilt he had wakened to.

"It's a good-bye feast we're having for you, Chirp, and ye're going to twitter for us."

Ansset shook his head.

"If ye can sing for the bastarrd Mikal, ye can sing for honest freemen."

Ansset's eyes blazed. "Watch how you speak of him, you barbarian traitor! He's your emperor!"

Master advanced a step, raising his hand angrily. "My orders was not to mark you, Chirp, but I can give you pain that doesn't leave a scar if ye don't mind how you talk to a freeman. Now ye'll sing."

Ansset, afraid of the man's brutality as only someone who has never known physical punishment can be afraid,

JANET AULISIO

nodded—but still hung back. "Can you please give me my clothing?"

"It ain't cold where we're going," Master retorted.

"I've never sung like this," Ansset said, embarrassed. "I've never performed without clothing."

Master leered. "What is it then that you *do* without clothing? Mikal's catamite has naw secrets we can't see."

Ansset didn't understand the word, but he understood the leer, and he followed Master out the door and down a dark corridor with his heart even more darkly filled with shame. He wondered why they were having a "good-bye feast" for him. Was he to be set free? (Had someone paid some unknown ransom for him?) Or was he to be killed?

The floor rocked gently as they walked down the wooden corridor. Ansset had long since decided he was imprisoned on a ship. The amount of real wood used in it would have seemed gaudy and pretentious in a rich man's home. Here it seemed only shabby.

Far above he could hear the distant cry of a bird, and a steady singing sound that he imagined to be wind whipping through ropes and cables. He had sung the melody himself sometimes, and often harmonized.

And then Master opened the door and with a mocking bow indicated that Ansset should enter first. The boy stopped in the doorframe. Gathered around a long table were twenty or so men, some of whom he had seen before, all of them dressed in the strange costumes of Earth barbarians. Ansset couldn't help remembering Mikal's raucous laughter whenever they came to court, pretending to be heirs of great civilizations that to minds accustomed to thinking on a galactic scale were petty and insignificant indeed. And yet as he stood looking at their rough faces and unsmiling eyes, he felt that it was he, with the soft skin of the imperial court, that was petty and insignificant, a mere naked child, while these men held the strength of worlds in their rough, gnarled hands.

They looked at him with the same curious, knowing, lustful look that Master had given him. Ansset relaxed his stomach and firmed his back and ribs to conquer emotion, as he had been taught in the Songhouse before he turned three. He stepped into the room.

"Up on the table!" roared Master behind him, and hands lifted him onto the wood smeared with spilled wine and rough with crumbs and fragments of food. "Now sing, ye little bastarrd."

The eyes looked his naked body over, and Ansset almost cried. But he was a Songbird, and many called him the best who had ever lived. Hadn't Mikal brought him from one end of the galaxy to his new Capital on old Earth? And when he sang, no matter who the audience, he would sing well.

And so he closed his eyes and shaped the ribs around his lungs, and let a low tone pass through his throat. At first he sang without words, soft

and low, knowing the sound would be hard to hear. "Louder," someone said, but he ignored the instructions. Gradually the jokes and laughter died down as the men strained to hear.

The melody was a wandering one, passing through tones and quartertones easily, gracefully, still low in pitch, but rising and falling rhythmically. Unconsciously Ansset moved his hands in strange gestures to accompany his song. He was never aware of those gestures, except that once he had read in a newsheet, "To hear Mikal's Songbird is heavenly, but to watch his hands dance as he sings is nirvana." That was a prudent thing to write about Mikal's favorite—when the writer lived in Capital. Nevertheless, no one had even privately disputed the comment.

And now Ansset began to sing words. They were words of his own captivity, and the melody became high, in the soft upper notes that opened his throat and tightened the muscles at the back of his head and tensed the muscles along the front of his thighs. The notes pierced, and as he slid up and down through haunting thirdtones (a technique that few Songbirds could master) his words spoke of dark, shameful evenings in a dirty cell, a longing for the kind looks of Father Mikal (not by name, never by name in front of these barbarians), of dreams of the broad lawns that stretched from the palace to the Susquehanna River, and of lost, forgotten days that ended in wakeful evenings in a tiny cell of splintered wood.

And he sang of his guilt.

At last he became tired, and the song drifted off into a whispered dorian scale that ended on the wrong note, on a dissonant note that faded into silence that sounded like part of the song.

Finally Ansset opened his eyes. All the men who were not weeping were watching him. None seemed willing to break the mood, until a youngish man down the table said in the thick accent, "Ah, but thet was better than hame and Mitherma." His comment was greeted by sighs and chuckles of agreement, and the looks that met Ansset's eyes were no longer leering and lustful, but rather soft and kind. Ansset had never thought to see such looks in those rough faces.

"Will ye have some wine, boy?" asked Master's voice behind him, and Husk poured. Ansset sipped the wine, and dipped a finger in it to cast a drop into the air in the graceful gesture of court. "Thank you," he said, handing back the metal cup with the same grace he would have used with a goblet at court. He lowered his head, though it hurt him to use that gesture of respect to such men, and asked, "May I leave now?"

"Do you have to? Can't you sing again?" the men around the table murmured, as if they had forgotten he was their prisoner. And Ansset refused as if he were free to choose. "I can't do it twice. I can never do it twice."

They lifted him off the table, then, and Master's strong arms carried him

back to his room. Ansset lay on the bed after the door locked shut, trembling. The last time he had sung was for Mikal, and the song had been light and happy. Then Mikal had smiled the soft smile that only touched his old face when he was alone with his Songbird, had touched the back of Ansset's hand, and Ansset had kissed the old hand and gone out to walk along the river. It was then that they had taken him—rough hands from behind, the sharp slap of the needle, and then waking in the cell where now he lay looking at the walls.

He always woke in the evening, aching from some unknown effort of the day, and wracked by guilt. He strained to remember, but always in the effort drifted off to sleep, only to wake again the next evening suffering from the lost day behind him. But tonight he did not try to puzzle out what lay behind the blocks in his mind. Instead he drifted off to sleep thinking of the songs in Mikal's kind gray eyes, humming of the firm hands that ruled an empire a galaxy wide and could still stroke the forehead of a sweet-singing child and weep at a sorrowful song. Ah, sang Ansset in his mind, ah, the weeping of Mikal's sorrowful hands.

Ansset woke walking down a street.

"Out of the way, ya chark!" shouted a harsh accent behind him, and Ansset dodged to the left as an eletrecart zipped past his right arm. "Sausages," shouted a sign on the trunk behind the driver.

Then Ansset was seized by a terrible vertigo as he realized that he was not in the cell of his captivity, that he was fully dressed (in native Earth costume, but clothing for all that), was alive, was free. The quick joy that realization brought was immediately soured by a rush of the old guilt, and the conflicting emotions and the suddenness of his liberation were too much for him, and for a moment too long he forgot to breathe, and the darkening ground slid sideways, tipped up, hit him—

"Hey, boy, are you all right?"

"Did the chark slam you, boy?"

"Ya got the license number? Ya got the number?"

"Four-eight-seven something, who can tell."

"He's comin' around and to."

Ansset opened his eyes. "Where is this place?" he asked softly.

Why, this is Northet, they said.

"How far is the palace?" Ansset asked, vaguely remembering that Northet was a town not far to the north and east of Capital.

"The palace? What palace?"

"Mikal's palace—I must go to Mikal—" Ansett tried to get up, but his head spun and he staggered. Hands held him up.

"The kit's kinky, that's what."

"Mikal's palace."

"It's only eighteen kilometer, boy, ya plan to fly?"

The joke brought a burst of laughter, but Ansset impatiently regained control of his body and stood. Whatever drug had kept him unconscious

was now nearly worked out of his system. "Find me a policeman," Ansset said. "Mikal will want to see me immediately."

Some still laughed, a man's voice said, "We'll be sure to tell him you're here when he comes to my house for supper!" but some others looked carefully at Ansset, realizing he spoke without American accent, and that his bearing was not that of a streetchild, despite his clothing. "Who are you, boy?"

"I'm Ansset. Mikal's Songbird."

Then there was silence, and half the crowd rushed off to find the policeman, and the other half stayed to look at him and realize how beautiful his eyes were, to touch him with their own eyes and hold the moment to tell about it to children and grandchildren. Ansset, Mikal's Songbird, more valuable than all the treasure Mikal owned.

"I touched him myself, helping him up, I held him up."

"You would've fallen, but for me, Sir," said a large strong man bowing ridiculously low.

"Can I shake your hand, Sir?"

Ansset smiled at them, not in amusement but in gratitude for their respect for him. "Thank you. You've all helped me. Thank you."

The policeman came, and after apologizing for the dirtiness of his armored eletrecart he lifted Ansset onto the seat and took him to the headquarters, where a flyer from the palace was already settling down on the pad. The Chamberlain leaped from the flyer, along with half a dozen servants, who gingerly touched Ansset and helped him to the flyer. The door slid shut, and Ansset closed his eyes to hide the tears as he felt the ground rush away as the palace came to meet him.

But for two days they kept him away from Mikal. "Quarantine," they said at first, until Ansset stamped his foot and said, "Nonsense," and refused to answer any more of the hundreds of questions they kept firing at him from dawn to dark and long after dark. The Chamberlain came.

"What's this I hear about you not wanting to answer questions, my boy?" asked the Chamberlain with the false joviality that Ansset had long since learned to recognize as a mask for anger or fear.

"I'm not your boy," Ansset retorted, determined to frighten some cooperation out of the Chamberlain. Now and then it had worked in the past. "I'm Mikal's and he wants to see me. Why am I being kept like a prisoner?"

"Quaran—"

"Chamberlain, I'm healthier than I've ever been before, and these questions don't have a thing to do with my health."

"All right," the Chamberlain said, fluttering his hands with impatience and nervousness. Ansset had once sung to Mikal of the Chamberlain's hands, and Mikal had laughed for hours at some of the words. "I'll explain. But don't get angry at me, because it's Mikal's orders."

"That I be kept away from him?"

"Until you answer the questions! You've been in court long enough, Songbird, and you're surely bright enough to know that Mikal has enemies in this world."

"I know that. Are you one of them?" Ansset was deliberately goading the Chamberlain, using his voice like a whip in all the ways that made the Chamberlain angry and fretful and so forgetful.

"Hold your tongue, boy!" the Chamberlain said. Ansset inwardly smiled. Victory. "You're also bright enough to know that you weren't kidnapped five months ago by any friends of the emperor's. We have to know *everything* about your captivity."

"I've told you everything a hundred times over."

"You haven't told us how you spent your days."

Again Ansset felt a stab of emotion. "I don't remember my days."

"And that's why you can't see Mikal!" the Chamberlain snapped. "Do you think we don't know what happened? We've used the probes and the tasters and no matter how skillfully we question, we can't get past the blocks. Either the person who worked on your mind laid the blocks very skillfully, or you yourself are holding them locked, and either way we can't get in."

"I can't help it," Ansset said, realizing now what the questioning meant. "How can you think I mean any danger to Father Mikal."

The Chamberlain smiled beatifically, in the pose he reserved for polite triumph. "Behind the block, someone may have very carefully planted a command for you to—"

"I'm not an assassin!" Ansset shouted.

"How would you know," the Chamberlain snarled back. "It's my duty to protect the person of the emperor. Do you know how many assassination attempts we stop? Dozens, every week. The poison, the treason, the weapons, the traps, that's what half the people who work here *do*, is watch everyone who comes in and watch each other too. Most of the assassination attempts are stopped immediately. Some get closer. Yours may be the closest of all."

"Mikal must want to see me!"

"Of course he does, Ansset! And that's exactly why you can't—because whoever worked on your mind must know that you're the only person that Mikal would allow near him after something like this—Ansset! Ansset, you little fool! Call the Captain of the Guard. Ansset, slow down!"

But the Chamberlain was slowing down with age, and he steadily lost ground to Ansset as the boy darted down the corridors of the palace. Ansset knew all the quickest ways, since exploring the palace was one of the most pleasant of his pastimes, and in five years in Mikal's service no one knew the labyrinth better than Ansset.

He was stopped routinely at the doors to the Great Hall, and he quickly made his way through the detectors (poison? No. Metal? No. Energy? No. Identification? Clear)

and he was just about to step through the vast doors when the Captain of the Guard arrived.

"Stop the boy."

Ansset was stopped.

"Come back here, Songbird," the Captain barked. But Ansset could see, at the far end of the huge platinum room, the small chair and the white-haired man who sat on it. Surely Mikal could see him! Surely he'd call!

"Bring the boy back here before he embarrasses everyone by calling out." Ansset was dragged back. "If you must know, Ansset, Mikal gave me orders to bring you within the hour, even before you made your ridiculous escape from the Chamberlain. But you'll be searched first. My way."

Ansset was taken off into one of the search rooms. He was stripped and his clothing was replaced with fresh clothes (that didn't fit! Ansset thought angrily), and then the searchers' fingers probed, painfully and deep, every aperture of his body that might hold a weapon. ("No weapon, and your prostate gland's all right, too," one of them joked. Ansset didn't laugh.) Then the needles, probing far under the skin to sample for hidden poisons. A layer of skin was bloodlessly peeled off his palms and the soles of his feet, to be sampled for poisons or flexible plastic needles. The pain was irritating. The delay was excruciating.

But Ansset bore what had to be borne. He only showed anger or impatience when he thought that doing so might gain some good effect. No one,

not even Mikal's Songbird, survived long at court unless he remained in control of his temper, however he had to hide it.

At last Ansset was pronounced clean.

"Wait," the Captain of the Guard said. "I don't trust you yet."

Ansset gave him a long, cold look. But the Captain of the Guard—like the Chamberlain—was one of the few people at court who knew Mikal well enough to know they had nothing to fear from Ansset unless they really treated him unjustly, for Mikal never did favors, not even for the boy, who was the only human being Mikal had ever shown a personal need for. And they knew Ansset well enough to know that he would never ask Mikal to punish someone unfairly, either.

The Captain took a nylon cord and bound Ansset's hands together behind him, first at the wrists, and then just below the elbows. The constriction was painful.

"You're hurting me," Ansset said.

"I may be saving my emperor's life," the Captain answered blandly. And then Ansset passed through the huge doors to the Great Hall, his arms bound, surrounded by guards with lasers drawn, preceded by the Captain of the Guard.

Ansset still walked proudly, but he felt a hearty fury toward the guards, toward the courtiers and supplicants and guards and officials lining the walls of the unfurnished room, and especially toward the Captain. Only toward Mikal did he feel no anger.

They let him stop.

Mikal raised his hand in the ritual of recognition. Ansset knew that Mikal laughed at the rituals when they were alone together—but in front of the court, the ritual had to be followed strictly.

Ansset dropped to his knees on the cold and shining platinum floor.

"My Lord," he said in clear, bell-like tones that he knew would reverberate from the metal ceiling, "I am Ansset, and I have come to ask for my life." In the old days, Mikal had once explained, that ritual had real meaning, and many a rebel lord or soldier had died on the spot. Even now, the pro forma surrender of life was taken seriously, as Mikal maintained constant vigilance over his empire.

"Why should I spare you?" Mikal asked, his voice old but firm. Ansset thought he heard a quaver of eagerness in the voice. More likely a quaver of age, he told himself. Mikal would never allow himself to reveal emotion in front of the court.

"You should not," Ansset said. This was leaving the ritual, and going down the dark road that met danger head-on. Mikal must have been told of the Chamberlain's fears. Therefore, if Ansset made any attempt to hide the danger, his life would be forfeited by law.

"Why not?" Mikal said, impassively.

"Because, my Lord Mikal Imperator, I was kidnapped and held for five months, and during those months things were done to me that are now

locked behind blocks in my mind. I may, unwittingly, be an assassin. I must not be allowed to live."

"Nevertheless," Mikal answered, "I grant you your life."

Ansset, his muscles strong enough even after his captivity to allow him to bow despite his bound arms, touched his lips to the floor.

"Why are you bound?"

"For your safety, my Lord."

"Unbind him," said Mikal. The Captain of the Guard untied the nylon cord.

His arms free, Ansset stood. He went beyond form, and he turned his voice into a song, with an edge to his voice that snapped every head in the hall toward him. "My Lord, Father Mikal," he sang, "there is a place in my mind where even I cannot go. In that place my captors may have taught me to want to kill you." The words were a warning, but the song said safety, the song said love, and Mikal arose from his throne. He understood what Ansset was asking and he would grant it.

"I would rather, my Son Ansset, I would rather meet death in your hands than any other's. Your life is more valuable to me than my own." Then Mikal turned and went back into the door that led to his private chambers. Ansset and the Captain of the Guard followed, and as they left the whispers rose to a roar. Mikal had gone much farther than Ansset had even hoped. The entire Capital—and in a few weeks, the entire empire—would hear how Mikal had called his Songbird *Son Ansset*, and the words, "Your life is more valuable to me than my own," would become the stuff of legends.

Ansset sighed a song as he entered the familiar rooms where Father Mikal lived.

Mikal turned abruptly and glared at the Captain of the Guard. "What did you mean by that little trick, you bastard?"

"I tied his hands as a precaution. I was within my duties as a warden of the gate."

"I know you were within your duties, but you might use some common decency. What harm can an eleven-year-old boy do when you've probably already skinned him alive searching for weapons and you have a hundred lasers trained on him at every moment!"

"I wanted to be sure."

"Well, you're too damned thorough. Get out. And don't let me ever catch you being any less thorough, even when it makes me angry. Get out!" The Captain of the Guard left, Mikal's roar following him. As soon as the door closed, Mikal started to laugh. "What an ass! What a colossal donkey!" Then he threw himself to the floor with all the vigor of a young man, though Ansset knew his age to be one hundred and twenty-three, which was old, in a civilization where death normally came at a hundred and fifteen. Under him the floor that had been rigid when his weight pressed down on the two small spaces touched by his feet now softened, gave gently to fit the contours of his body. Ansset

also went to the floor, and lay there laughing.

"Are you glad to be home, Ansset?" Mikal asked tenderly.

"Now I am. Until this moment I wasn't home."

"Ansset, my Son, you never can speak without singing." Mikal laughed softly.

Ansset took the sound of the laugh and turned it into a song. It was a soft song, and it was short, but at the end of it Mikal was lying on his back looking at the ceiling, tears streaming down from his eyes.

"I didn't mean the song to be sad, Father Mikal."

"How was I to know that now, in my dotage, I'd do the foolish thing I avoided all my life? Oh, I've loved like I've done every other passionate thing, but when they took you I discovered, my Son, that I need you." Mikal rolled over and looked at the beautiful face of the boy who lay looking at him adoringly. "Don't worship me, boy, I'm an old bastard who'd kill his mother if one of my enemies hadn't already done it."

"You'd never harm me."

"I harm everything I love," Mikal said bitterly. Then he let his face show concern. "We were afraid for you. Since you were gone there was an outbreak of insane crime. People were kidnapped for no reason on the street, some in broad daylight, and a few days later their bodies would be found, broken and torn by someone or something. No ransom notes. Nothing. We thought you had been taken like that, and that somewhere we'd find your body. Are you whole? Are you well?"

"I'm stronger than I've ever been before." Ansset laughed. "I tested my strength against the hook of my hammock, and I'm afraid I ripped it out of the wall."

Mikal reached out and touched Ansset's hand. "I'm afraid," Mikal said, and Ansset listened, humming softly, as Mikal talked. The emperor never spoke in names and dates and facts and plans, for then if Ansset were taken by an enemy the enemy would know too much. He spoke to the Songbird in emotions instead, and Ansset sang solace to him. Other Songbirds had pretty voices, others could impress the crowds, and, indeed, Mikal used Ansset for just that purpose on certain state occasions. But of all Songbirds, only Ansset could sing his soul; and he loved Mikal from his soul.

Late in the night Mikal shouted in fury about his empire: "Did I build it to fall? Did I burn over a dozen worlds and rape a hundred others just to have the whole thing fall in chaos when I die?" He leaned down and whispered to Ansset, their eyes a few inches apart, "They call me Mikal the Terrible, but I built it so it would stand like an umbrella over the galaxy. They have it now: peace and prosperity and as much freedom as their little minds can cope with. But when I die they'll throw it all away." Mikal whirled and shouted at the walls of his soundproofed chamber, "In the name of

nationalities and religions and races and family inheritances the fools will rip the umbrella down and then wonder why, all of a sudden, it's raining."

Ansset sang to him of hope.

"There's no hope. I have fifty sons, three of them legitimate, all of them fools who try to flatter me. They couldn't keep the empire for a week, not all of them, not any of them. There's not a man I've met in all my life who could control what I've built in my lifetime. When I die, it all dies with me." And Mikal sank to the floor wearily.

For once Ansset did not sing. Instead he jumped to his feet, the floor turning firm under him. He raised an arm above his head, and said, "For you, Father Mikal, I'll grow up to be strong! Your empire shall not fall!" He spoke with such grandeur in his childish speaking voice that both he and Mikal had to laugh.

"It's true, though," Mikal said, tousling the child's hair. "For you I'd do it, I'd give you the empire, except they'd kill you. And even if I lived long enough to train you to be a ruler of men, I wouldn't do it. The man who will be my heir must be cruel and vicious and sly and wise, completely selfish and ambitious, contemptuous of all other people, brilliant in battle, able to outguess and outmaneuver every enemy, and strong enough inside himself to live utterly alone all his life." Mikal smiled. "Even *I* don't fit my list of qualifications, because now I'm not utterly alone."

And then, as Mikal drifted off to sleep, Ansset sang to him of his captivity, the songs and words of his time of loneliness in captivity, and as the men on the ship had wept, so Mikal wept, only more. Then they both slept.

A few days later Mikal, Ansset, the Chamberlain, and the Captain of the Guard met in Mikal's small receiving room, where a solid block of clear glass as perfect as a lens stretched as a meters-long table from one end of the room to the other. They gathered at one end. The Chamberlain was adamant.

"Ansset is a danger to you, my Lord."

The Captain of the Guard was equally adamant. "We found the conspirators and killed them all."

The Chamberlain rolled his eyes heavenward in disgust.

The Captain of the Guard became angry, though he kept the fact hidden behind heavy-lidded eyes. "It all fit—the accent that Ansset told us they had, the wooden ship, calling each other freemen, their emotionalism—they could have been no one else but the Freemen of Eire. Just another nationalist group, but they have a lot of sympathizers here in America—damn these 'nations,' where but on old Earth would people subdivide their planet and think the subdivisions meant anything."

"So you went in and wiped them all out," the Chamberlain sneered, "and not one of them had any knowledge of the plot."

"Anyone who could block out the Songbird's mind as well as he did can

hide a conspiracy like that!" the Captain of the Guard snapped back.

"Our enemy is subtle," the Chamberlain said. "He kept everything else from Ansset's knowledge—so why did he let him have all these clues that steered us to Eire? I think we were given bait and you bit. Well, I haven't bitten yet, and I'm still looking."

"In the meantime," Mikal said, "try to avoid harassing Ansset too much."

"I don't mind," Ansset hurriedly said, though he minded very much: the constant searches, the frequent interrogations, the hypnotherapy, the guards who followed him constantly to keep him from meeting with anyone.

"I mind," Mikal said. "It's good for you to keep watch, because we still don't know what they've done to Ansset's mind. But in the meantime, let Ansset's life be worth living." Mikal glared pointedly at the Captain of the Guard, who got up and left. Then Mikal turned to the Chamberlain and said, "I don't like how easily the Captain was fooled by such an obvious ploy. Keep up your investigation. And tell me anything your spies within the Captain's forces might have to say."

The Chamberlain tried for a moment to protest that he had no such spies—but Mikal laughed until the Chamberlain gave up and promised to complete a report.

"My days are numbered," Mikal said to Ansset. "Sing to me of numbered days." And so Ansset sang him a playful song about a man who decided to live for two hundred years and so counted his age backward, by the number of years he had left. "And he died when he was only eighty-three," Ansset sang, and Mikal laughed and tossed another log on the fire. Only an emperor or a peasant in the protected forests of Siberia could afford to burn wood.

Then one day Ansset, as he wandered through the palace, noticed a different direction and a quickened pace to the hustling and bustling of servants down the halls. He went to the Chamberlain.

"Try to keep quiet about it," the Chamberlain said. "You're coming with us, anyway."

And within an hour Ansset rode beside Mikal in an armored car as a convoy swept out of Capital. The roads were kept clear, and in an hour and fifteen minutes the armored car stopped. Ansset bounded out of the hatchway. He was startled to see that the entire convoy was missing, and only the single armored car remained. He immediately suspected treachery, and looked down at Mikal in fright.

"Don't worry, " Mikal said. "We sent the convoy on."

They got out of the car and with a dozen picked guards (not from the palace guard, Ansset noticed) they made their way through a sparse wood, along a stream, and finally to the banks of a huge river.

"The Delaware," whispered the Chamberlain to Ansset, who had already guessed as much.

"Keep your esoterica to yourself," Mikal said, sounding irritable, which meant he was enjoying himself im-

mensely. He hadn't been a part of any kind of planetside military operation in forty years, ever since he became an emperor and had to control fleets and planets instead of a few ships and a thousand men. There was a spring to his step that belied his century and a quarter.

Finally the Chamberlain stopped. "That's the house, and that's the boat."

A flatboat was moored on the river by a shambling wooden house that looked like it had been built during the American colonial revival over a hundred years before.

They crept up on the house, but it was empty, and when they rushed the flatboat the only man on board aimed a laser at his own face and blasted it to a cinder. Not before Ansset had recognized him, though.

"That was Husk," Ansset said, feeling sick as he looked at the ruined corpse. Inexplicably, he felt a nagging guilt. "He's the man who fed me."

Then Mikal and Chamberlain followed Ansset through the boat. "It's not the same," Ansset said.

"Of course not," said the Chamberlain. "The paint is fresh. And there's a smell of new wood. They've been remodeling. But is there anything familiar?"

There was. Ansset found a tiny room that could have been his cell, though now it was painted bright yellow and a new window let sunlight flood into the room. Mikal examined the windowframe. "New," the emperor pronounced. And by trying to imagine the interior of the flatboat as it might have been unpainted, Ansset was able to find the large room where he had sung his last evening in captivity. There was no table. But the room seemed the same size, and Ansset agreed that this could very well have been the place he was held.

Down in the ship they heard the laughter of children and a passing eletrecart that clattered along the bumpy old, asphalt road. The Chamberlain laughed. "Sorry I took you the long way. It's really quite a populated area. I just wanted to be sure they didn't have time to be warned."

Mikal curled his lip. "If it's a populated area we should have arrived in a bus. A group of armed men walking along a river are much more conspicuous."

"I'm not a tactician," said the Chamberlain.

"Tactician enough," said Mikal. "We'll go back to the palace now. Do you have anyone you can trust to make the arrest? I don't want him harmed."

But it didn't do any good to give orders to that effect. When the Captain of the Guard was arrested, he raged and stormed and then a half-hour later, before there was time to examine him with the probe and taster, one of the guards slipped him some poison and he drifted off into death. The Chamberlain rashly had the offending guard impaled with nails until he bled to death.

Ansset was confused as he watched Mikal rage at the Chamberlain. It was

obviously a sham, or half a sham, and Ansset was certain that the Chamberlain knew it. "Only a fool would have killed that soldier! How did the poison get into the palace past the detectors? How did the soldier get it to the Captain? None of the questions will ever be answered now!"

The Chamberlain made the mandatory ritual resignation. "My Lord Imperator, I was a fool. I deserve to die. I resign my position and ask for you to have me killed."

Following the ritual, but obviously annoyed by having it thrust at him before he was through raging, Mikal lifted his hand and said, "Damn right you're a fool." Then, in proper form, he said, "I grant you your life because of your infinitely valuable services to me in apprehending the traitor in the first place." Mikal cocked his head to one side. "So, Chamberlain, who do you think I should make the next Captain of the Guard?"

Ansset almost laughed out loud. It was an impossible question to answer. The safest answer (and the Chamberlain liked to do safe things) would be to say he had never given the matter any thought at all, and wouldn't presume to advise the emperor on such a vital matter. But even so, the moment would be tense for the Chamberlain.

And Ansset was shocked to hear the Chamberlain answer, "Riktors Ashen, of course, my Lord."

The "of course" was insolent. The naming of the man was ridiculous. At first Ansset looked at Mikal to see fury there. But instead Mikal was smiling. "Why of course," he said blandly. "Riktors Ashen is the obvious choice. Tell him in my name that he's appointed."

Even the Chamberlain, who had mastered the art of blandness at will, looked surprised for a moment. Again Ansset almost laughed. He saw Mikal's victory: the Chamberlain had probably named the one man in the palace guard that the Chamberlain had no control over, assuming that Mikal would never pick the man the Chamberlain recommended. And so Mikal had picked him: Riktors Ashen, the victor of the battle of Mantrynn, a planet that had revolted only three

years before. He was known to be incorruptible, brilliant, and reliable. Well, now he'd have a chance to prove his reputation, Ansset thought.

Then he was startled out of his reverie by Mikal's voice. "Do you know what his last words were to me?"

By the instant understanding that needed no referents for Mikal's pronouns Ansset knew he was talking about the now-dead Captain of the Guard.

"He said, 'Tell Mikal that my death frees more plotters than it kills.' And then he said that he loved me. Imagine, that cagey old bastard saying he loved me. I remember him twenty years ago when he killed his closest friend in a squabble over a promotion. The bloodiest men get most sentimental in their old age, I suppose."

Ansset asked a question—it seemed a safe time. "My Lord, why was the Captain arrested?"

"Hmmm?" Mikal looked surprised. "Oh, I suppose no one told you, then. He visited that house regularly throughout your captivity. He said he visited a woman there. But the neighbors all testified under the probe that a woman never lived there. And the Captain was a master at establishing mental blocks."

"Then the conspiracy is broken!" Ansset said, joyfully assuming that the guards would stop harassing him and the questions would finally end.

"The conspiracy is barely dented. Someone was able to get poison to the Captain. Therefore plotters still exist within the palace. And therefore Riktors Ashen will be instructed to keep a close watch on you."

Ansset tried to keep the smile on his face. He failed.

"I know, I know," Mikal said wearily. "But it's still locked in your mind."

It was unlocked the next day. The court was gathered in the Great Hall, and Ansset resigned himself to a morning of wandering through the halls—or else standing near Mikal as he received the boring procession of dignitaries paying their respects to the emperor (and then going home to report how soon they thought Mikal the Terrible would die, and who might succeed him, and what the chances were for grabbing a piece of the empire). Because the palace bored him and he wanted to be near Mikal, and because the Chamberlain smiled at him and asked, "Are you coming to court?" Ansset decided to attend.

The order of dignitaries had been carefully worked out to honor loyal friends and humiliate upstarts whose dignity needed deflating. A minor official from a distant star cluster was officially honored, the first business of the day, and then the rituals began: princes and presidents and satraps and governors, depending on what title survived the conquest a decade or a score or fourscore years ago, all proceeding forward with their retinue, bowing (how low they bowed showed how afraid they were of Mikal, or how much they wanted to flatter him), uttering a few words, asking for pri-

vate audience, being put off or being invited, in an endless array.

Ansset was startled to see a group of Black Kinshasans attired in their bizarre old Earth costumes. Kinshasa insisted it was an independent nation, a pathetic nose-thumbing claim when empires of planets had been swallowed up by Mikal Conqueror. Why were they being allowed to wear their native regalia and have an audience? Ansset raised an eyebrow at the Chamberlain, who also stood near the throne.

"It was Mikal's idea," the Chamberlain said voicelessly. "He's letting them come and present a petition right before the president of Stuss. Those toads from Stuss'll be madder than hell."

At that moment Mikal raised his hand for some wine. Obviously he was as bored as anyone else.

The Chamberlain poured the wine, tasted it, as was the routine, and then took a step toward Mikal's throne. Then he stopped, and beckoned to Ansset, who was already moving back to Mikal's side. Surprised at the summons, Ansset came over.

"Why don't *you* take the wine to Mikal, Sweet Songbird?" the Chamberlain said. The surprise fell away from Ansset's eyes, and he took the wine and headed purposefully back to Mikal's throne.

At that moment, however, pandemonium broke loose. The Kinshasan envoys reached into their elaborate curly-haired headdresses and withdrew wooden knives—which could pass every test given by machines at the doors of the palace. They rushed toward the throne. The guards fired quickly, their lasers dropping five of the Kinshasans, but all had aimed at the foremost assassins, and three continued unharmed. They rushed toward the throne, arms extended so the knives were already aimed directly at Mikal's heart.

Mikal, old and unarmed, rose to meet them. A guard managed to shift his aim and get off a shot, but it was wild, and the others were hurriedly recharging their lasers—which only took a moment, but that was a moment too long.

Mikal looked death in the eye and did not seem disappointed.

But at that moment Ansset threw the wine goblet at one of the attackers and then leaped out in front of the emperor. He jumped easily into the air, and kicked the jaw of the first of the attackers. The angle of the kick was perfect, the force sharp and incredibly hard, and the Kinshasan's head flew fifty feet away into the crowd, as his body slid forward until the wooden knife touched Mikal's foot. Ansset came down from the jump in time to bring his hand upward into the abdomen of another attacker so sharply that his arm was buried to the elbow in bowels, and his fingers crushed the man's heart.

The other attacker paused just a moment, thrown from his relentless charge by the sudden onslaught from the child who stood so harmlessly by the emperor's throne. That pause was long enough for recharged lasers to be

aimed, to flash, and the last Kinshasan assassin fell, dropping ashes as he collapsed, flaming slightly.

The whole thing, from the appearance of the wooden knives to the fall of the last attacker, had taken five seconds.

Ansset stood still in the middle of the hall, gore on his arm, blood splashed all over his body. He looked at the gory hand, at the body he had pulled it out of. A rush of long-blocked memories came back, and he remembered other such bodies, other heads kicked from torsos, other men who had died as Ansset learned the skill of killing with his hands. The guilt that had troubled him before swept through him with new force now that he knew the why of it.

The searches had all been in vain. Ansset himself was the weapon that was to have been used against Father Mikal.

The smell of blood and broken intestines combined with the emotions sweeping his body, and he doubled over, shuddering as he vomited.

The guards gingerly approached him, unsure what they should do.

But the Chamberlain was sure. Ansset heard the voice, trembling with fear at how close the assassination had come, and how easily a different assassination could have come, saying, "Keep him under guard. Wash him. Never let him be out of a laser's aim for a moment. Then bring him to Mikal's chambers in an hour."

The guards looked toward Mikal, who nodded.

Ansset was still white and weak when he came into Mikal's chambers. The guards still had lasers trained on him. The Chamberlain and the new Captain of the Guard, Riktors Ashen, stood between Mikal and the boy.

"Songbird," Riktors said, "it seems that someone taught you new songs."

Ansset lowered his head.

"You must have studied under a master."

"I n-never," Ansset stuttered. He had never stuttered in his life.

"Don't torture the boy, Captain," Mikal said.

The Chamberlain launched into his pro forma resignation. "I should have examined the boy's muscle structure and realized what new skills he had been given. I submit my resignation. I beg you to take my life."

The Chamberlain must be even more worried than usual, Ansset thought with that part of his mind that was still capable of thinking. The old man had prostrated himself in front of the emperor.

"Shut up and get up," Mikal said rudely. The Chamberlain arose with his face gray. Mikal had not followed the ritual. The Chamberlain's life was still on the line.

"We will now be certain," Mikal said to Riktors. "Show him the pictures."

Ansset stood watching as Riktors took a packet off a table and began removing newsheet clippings from it. Ansset looked at the first one and was merely sickened a little. The second one he recognized, and he gasped.

With the third one he wept and threw the pictures away from him.

"Those are the pictures," Mikal said, "of the people who were kidnapped and murdered during your captivity."

"I k-killed them," Ansset said, dimly aware that there was no trace of song in his voice, just the frightened stammering of an eleven-year-old boy caught up in something too monstrous for him to comprehend. "They had me practice on them."

"*Who* had you practice!" Riktors demanded.

"They! The voices—from the box." Ansset struggled to hold onto memories that had been hidden from him by the block. He also longed to let the block in his mind slide back into place, forget again, shut it out.

"What box?" Riktors would not let up.

"The box. A wooden box. Maybe a receiver, maybe a recording, I don't know."

"Did you know the voice?"

"Voices. Never the same. Not even for the same sentence, the voices changed for every word."

Ansset kept seeing the faces of the bound men he was told to maim and then kill. He remembered that though he cried out against it, he was still forced to do it.

"How did they force you to do it!"

Was Riktors reading his mind? "I don't know. I don't know. There were words, and then I had to."

"What words?"

"I don't know! I never knew!" And Ansset was crying again.

Mikal spoke softly. "Who taught you how to kill that way?"

"A man. I never knew his name. On the last day, he was tied where the others had been. The voices made me kill him." Ansset struggled with the words, the struggle made harder by the realization that this time, when he had killed his teacher, he had not had to be forced. He had killed because he hated the man. "I murdered him."

"Nonsense," the Chamberlain said. "You were a tool."

"I said to shut up," Mikal said curtly. "Can you remember anything else, my Son?"

"I killed the crew of the ship, too. All except Husk. The voices told me to. And then there were footsteps, above me, on the deck."

"Did you see who it was?"

Ansset forced himself to remember. "No. He told me to lie down. He must have known the—code, whatever it is, I didn't want to obey him, but I did."

"And?"

"Footsteps, and a needle in my arm, and I woke up on the street."

Everyone was silent then, for a few moments, all of them thinking quickly. The Chamberlain broke first. "My Lord, the great threat to you and the strength of the Songbird's love for you must have impelled him despite the mental block—"

"Chamberlain," Mikal said, "your life is over if you speak again before I address you. Captain. I want to know how those Kinshasan's got past your guard?"

"They were dignitaries. By your order, my Lord, no dignitaries are given the body search. Their wooden knives passed all the detectors. I'm surprised this hadn't been tried before."

Ansset noticed that Riktors spoke confidently, not coweringly as another Captain might have done after assassins got through his guard. And, better in control of himself, Ansset listened for the melodies of Riktors's voice. They were strong. They were dissonant. Ansset wondered if he would be able to detect Riktors in a lie. To a strong, selfish man all things that he chose to say became truth, and the songs of his voice said nothing.

"Riktors, you will prepare orders for the utter destruction of Kinshasa."

Riktors saluted.

"Before Kinshasa is destroyed—and that means destroyed, not a blade of grass, Riktors—before Kinshasa is destroyed, I want to know what connection there is between the assassination attempt this morning and the manipulation of my Songbird."

Riktors saluted again. Mikal spoke to the Chamberlain. "Chamberlain, what would you recommend I do with my Songbird?"

As usual, the Chamberlain took the safe way. "My Lord, it is not a matter to which I have given thought. The disposition of your Songbird is not a matter on which I feel it proper to advise you."

"Very carefully said, my dear Chamberlain." Ansset tried to be calm as he listened to them discuss how he should be disposed of. Mikal raised his hand in the gesture that, by ritual, spared the Chamberlain's life. Ansset would have laughed at the Chamberlain's struggle not to show his relief, but this was not a time for laughter, because Ansset knew his relief would not come so easily.

"My Lord," Ansset said, "I beg you to put me to death."

"Dammit, Ansset, I'm sick of the rituals," Mikal said.

"This is no ritual," Ansset said, his voice tired and husky from misuse. "And this is no song, Father Mikal. I'm a danger to you."

"I know it." Mikal looked back and forth beween Riktors and the Chamberlain.

"Chamberlain, have Ansset's possessions put together and readied for shipment to Alwiss. The prefect there is Timmis Hortmang, prepare a letter of explanation and a letter of mark. Ansset will arrive there wealthier than anyone else in the prefecture. Those are my orders. See to it." He turned his head downward and to the right. Both Riktors and the Chamberlain moved to leave. Ansset—and therefore the guards who had lasers trained on him—did not.

"Father Mikal," Ansset said softly, and he realized that the words had been a song.

But Mikal made no answer. He only got up from the chair and left the chamber.

Ansset had several hours before nightfall, and he spent them wander-

ing through the palace and the palace grounds. The guards dogged his steps. At first he let the tears flow. Then, as the horror of the morning hid again behind the only partly broken block in his mind, he remembered what the Songmaster had taught him, again and again, "When you want to weep, let the tears come through your throat. Let pain come from the pressure in your thighs. Let sorrow rise and resonate through your head."

Walking by the Susquehanna on the cold lawns of autumn afternoon shade, Ansset sang his grief. He sang softly, but the guards heard his song, and could not help but weep for him, too.

He stopped at a place where the water looked cold and clear, and began to strip off his tunic, preparing to swim. A guard reached out and stopped him. Ansset noticed the laser pointed at his foot. "I can't let you do that. Mikal gave orders you were not to be allowed to take your own life."

"I only want to swim," Ansset answered, his voice low with persuasion.

"I would be killed if any harm came to you," the guard said.

"I give you my oath that I will only swim, and not try to break free."

The guard considered. The other guards seemed content to leave the decision up to him. Ansset hummed a sweet melody that he knew oozed confidence. The guard gave in.

Ansset stripped and dove into the water. It was icy cold, and stung him. He swam in broad strokes upstream, knowing that to the guards on the bank he would already seem like only a speck on the surface of the river. Then he dove and swam under the water, holding his breath as only a singer or a pearldiver could, and swam across the current toward the near shore, where the guards were waiting. He could hear, though muffled by the water, the cries of the guards. He surfaced, laughing.

Two of the guards had already thrown off their boots and were up to their waists in water, preparing to try to catch Ansset's body as it swept by. But Ansset kept laughing at them, and they turned at him angrily.

"Why did you worry?" Ansset said. "I gave my word."

Then the guards relaxed, and Ansset swam for an hour under the afternoon sun. The motion of the water, and constant exertion to keep place against the current took his mind off his troubles, to some extent. Only one guard watched him now, while the others played polys, casting fourteen-sided dice in a mad gambling game that soon engrossed them.

Ansset swam underwater from time to time, listening to the different sound the guards' quarreling and laughing made when water covered his ears. The sun was nearly down, now, and Ansset dove underwater again to swim to shore on one breath. He was halfway to shore when he heard the sharp call of a bird overhead, muffled as it was by the river.

Ansset made a sudden connection in his mind, and came up immediately, coughing and sputtering. He dog-

paddled in to shore, shook himself, and put on his tunic, wet as he was.

"We've got to get back to the palace," he said, filling his voice with urgency, putting the pitch high to penetrate the guards' sluggishness after an hour of gaming. The guards quickly followed him, overtook him.

"Where are you going?" one of them asked.

"To see Mikal."

"We're not to do that—we were ordered! You can't go to Mikal."

But Ansset walked on, fairly sure that until he actually got close to the emperor the guards would not try to restrain him. Even if they had not been present for the demonstration of Ansset's skill in the Great Hall that morning, the story would surely have reached their ears that Mikal's Songbird could kill two men in two seconds.

He had heard the call of a bird as he swam underwater. He remembered that on his last night of captivity in the ship, he had heard the cry of another bird high above him. But never, never had he heard another sound from outside.

And yet where the flatboat was the city noise had come loudly, could be heard clearly below decks. Therefore even if the boat were his prison, it had not been moored by that house. And if that were so, the evidence against the former Captain of the Guard was a fraud. And Ansset knew now who in the court had taken Ansset to use as an assassin.

They were met in a corridor by a messenger. "There you are. The Lord Mikal commands the presence of the Songbird, as quickly as possible. Here," he said, handing the orders to the guard who made decisions, who took out his verifier and passed it over the seal on the orders. A sharp buzz testified that the orders were genuine.

"All right then, Songbird," said the guard. "We'll go there after all." Ansset started to run. The guards kept up easily, following him through the labyrinth. To them it was almost a game, and one of them said, between breaths, "I never knew this way led where we're going!" to which one of the other guards replied, "And you'll never find it again, either."

And then they were in Mikal's chambers. Ansset's hair was still wet, and his tunic still clung to his small body where it had not yet had time to dry from the river water.

Mikal was smiling. "Ansset, my Son, it's fine now." Mikal waved an arm, dismissing the guards. "We were so foolish to think we needed to send you away," he said. "The Captain was the only one in the plot close enough to give the signal. Now that he's dead, no one knows it! You're safe now—and so am I!"

Mikal's speech was jovial, delighted, but Ansset, who knew the songs of his voice as well as he knew his own, read in the words a warning, a lie, a declaration of danger. Ansset did not run to him. He waited.

"In fact," Mikal said, "you're my best possible bodyguard. You look

small and weak, you're always by my side, and you can kill faster than a guard with a laser." Mikal laughed. Ansset was not fooled. There was no mirth in the laugh.

But the Chamberlain and Captain Riktors Ashen were fooled, and they laughed along with Mikal. Ansset forced himself to laugh, too. He listened to the sounds the others were making. Riktors sounded sincere enough, but the Chamberlain—

"It's a cause for celebration. Here's wine," said the Chamberlain. "I brought us wine. Ansset, why don't you pour it?"

Ansset shuddered with memories. "I?" he asked, surprised, and then not surprised at all. The Chamberlain held out the full bottle and the empty goblet. "For the Lord Mikal," the Chamberlain said.

Ansset shouted and dashed the bottle to the floor. "Make him keep silent!"

The suddenness of Ansset's violent action brought Riktors's laser out of his belt and into his hand.

"Don't let the Chamberlain speak!"

"Why not?" asked Mikal innocently, but Ansset knew there was no innocence behind the words. For some reason Mikal was pretending not to understand.

The Chamberlain believed it, believed he had a moment. He said quickly, almost urgently, "Why did you do that? I have another bottle. *Sweet Songbird, let Mikal drink deeply!*"

The words hammered into Ansset's brain, and by reflex he whirled and faced Mikal. He knew what was happening, knew and screamed against it in his mind. But his hands came up against his will, his legs bent, he compressed to spring, all so quickly that he couldn't stop himself. He knew that in less than a second his hand would be buried in Mikal's face, Mikal's beloved face, Mikal's smiling face—

Mikal was smiling at him, kindly and without fear. Ansset stopped in midspring, forced himself to turn aside, despite the tearing in his brain. He could be forced to kill, but he couldn't be forced to kill that face. He shoved his hand into the floor, bursting the tense surface, releasing the gel to flow out across the room.

Ansset hardly noticed the pain in his arm where the impact had broken the skin and the gel was agonizing the wound. All he felt was the pain in his mind as he still struggled against the compulsion he had only just barely deflected, that still drove him to try to kill Mikal, that still he fought against, fought down, tried to block.

His body heaved upward, his hand flew threw the air, and shattered the back of the chair where Mikal still sat. Blood spurted and splashed, and Ansset was relieved to see that it was his own blood, and not Mikal's.

In the distance he heard Mikal's voice saying, "Don't shoot him." And, as suddenly as it had come, the compulsion ceased. His mind spun as he heard the Chamberlain's words fading

away: *"Songbird, what have you done!"*

Those were the words that had set him free.

Exhausted and bleeding, Ansset lay on the floor, his right arm covered with blood. The pain reached him now, and he groaned, though his groan was as much a song of ecstasy as of pain. Somehow Ansset had withstood it long enough, and he had not killed Father Mikal.

Finally he rolled over and sat up, nursing his arm. The bleeding had settled to a slow trickle.

Mikal was still sitting in the chair, despite its shattered back where Ansset's hand had struck. The Chamberlain stood where he had stood ten seconds before, at the beginning of Ansset's ordeal, the goblet looking ridiculous in his hand. Riktors's laser was aimed at the Chamberlain.

"Call the guards, Captain," Mikal said.

"I already have," Riktors said. The button on his belt was glowing. Guards came quickly into the room. "Take the Chamberlain to a cell," he ordered them. "If any harm comes to him, all of you will die and your families, too. Do you understand?" The guards understood.

Ansset held his arm. Mikal and Riktors Ashen waited while a doctor treated it. The pain subsided.

The doctor left.

Riktors spoke first. "Of course you knew it was the Chamberlain, my Lord."

Mikal smiled faintly.

"That was why you let him persuade you to call Ansset back here."

Mikal's smile grew broader.

"But, my Lord, only you could have known that the Songbird would be strong enough to resist a compulsion that was five months in the making."

Mikal laughed. And this time Ansset heard mirth in the laughter.

"Riktors Ashen. Will they call you Riktors the Usurper? Or Riktors the Great?"

It took the Captain of the Guard a moment to realize what had been said. Only a moment. But before his hand could reach his laser, which was back in his belt, Mikal's hand held a laser that was pointed at Riktors's heart.

"Ansset, my Son, will you take the Captain's laser from him?"

Ansset got up and took the Captain's laser from him. He could hear the song of triumph in Mikal's voice. But Ansset's head was still spinning, and he didn't understand why lasers had been drawn between the emperor and his incorruptible Captain.

"Only one mistake, Riktors. Otherwise brilliantly done. And I really don't see how you could have avoided the mistake, either."

"You mean Ansset's strength?"

"Not even I counted on that. I was prepared to kill him, if I needed to," Mikal said, and Ansset, listening, knew it was true. He wondered why that knowledge didn't hurt him. He had always known that, eventually, not even he would be indispensable to Mikal, if somehow his death served some vital purpose.

"Then I made no mistakes," Riktors said. "How did you know?"

"Because my Chamberlain, unless he were under some sort of compulsion, would never have had the courage to suggest your name as the Captain's successor. And without that, you wouldn't have been in a position to take over after you exposed the Chamberlain as the engineer of my assassination, would you? It was good. The guard would have followed you loyally. No taint of assassination would have touched you. Of course, the entire empire would have rebelled immediately. But you're a good tactician and a better strategist, and your men would have followed you well. I'd have given you one chance in four of making it—and that's better odds than any other man in the empire."

"I gave myself even odds," Riktors said, but Ansset heard the fear singing through the back of his brave words. Well, why not? Death was certain now, and Ansset knew of no one, except perhaps an old man like Mikal, who could look at death, especially death that also meant failure, without some fear.

But Mikal did not push the button on the laser.

"Kill me now and finish it," Riktors Ashen said.

Mikal tossed the laser away. "With this? It has no charge. The Chamberlain installed a charge detector at every door in my chambers over fifteen years ago. He would have known if I was armed."

Immediately Riktors took a step forward, the beginning of a rush toward the emperor. Just as quickly Ansset was on his feet, despite the bandaged arm ready to kill with the other hand, with his feet, with his head. Riktors stopped cold.

"Ah," Mikal said. "No one knows like you do what my bodyguard can accomplish in so short a time."

And Ansset realized that if Mikal's laser was not loaded, he couldn't have stopped Ansset if Ansset had not had strength enough to stop himself. Mikal *had* trusted him.

And Mikal spoke again. "Riktors, your mistakes were very slight. I hope you have learned from them. So that when an assassin as bright as you are tries to take *your* life, you know all the enemies you have and all the allies you can call on and exactly what you can expect from each."

Ansset's hands trembled. "Let me kill him now," he said.

Mikal sighed. "Don't kill for pleasure, my Son. If you ever kill for pleasure you'll come to hate yourself. Besides, weren't you listening? I'm going to adopt Riktors Ashen as my heir."

"I don't believe you," Riktors said. But Ansset heard hope in his voice.

"I'll call in my sons—they stay around court, hoping to be closest to the palace when I die," Mikal said. "I'll make them sign an oath to respect you as my heir. Of course they'll all sign it, and of course you'll have them all killed the moment you take the throne. And, let's see, that moment will be three weeks from tomorrow,

that should give us time. I'll abdicate in your favor, sign all the papers, it'll make the headlines on the newsheets for days. I can just see all the potential rebels tearing their hair with rage. It's a pleasant picture to retire on."

Ansset didn't understand. "Why?" he asked. "He tried to kill you."

Mikal only laughed. It was Riktors who answered. "He thinks I can hold his empire together. But I want to know the price."

Mikal leaned forward on his chair. "A small price. A house for myself and my Songbird until I die. And then he is to be free for the rest of his life, with an income that doesn't make him dependent on anybody's favors. Simple enough?"

"I agree."

"How prudent." And Mikal laughed again.

The vows were made, the abdication and coronation took a great deal of pomp and the Capital's caterers became wealthy. All the contenders were slaughtered, and Riktors spent a year going from system to system to quell (brutally) all the rebellions.

After the first few planets were burned over, the other rebellions mostly quelled themselves.

It was only the day after the newsheets announced the quelling of the most threatening rebellion that the soldiers appeared at the door of the little house in Brazil where Mikal and Ansset lived.

"How can he!" Ansset cried out in anguish when he saw the soldiers at the door. "He gave his word."

"Open the door for them, Son," Mikal said.

"They're here to kill you!"

"A year was all that I hoped for. I've had that year. Did you really expect Riktors to keep his word? There isn't room in the galaxy for two heads that know the feel of the imperial crown."

"I can kill most of them before they could come near. If you hide, perhaps—"

"Don't kill anyone, Ansset. That's not your song. The dance of your hands is nothing without the dance of your voice, Songbird."

The soldiers began to beat on the door, which, because it was steel, did not give way easily. "They'll blow it open in a moment," Mikal said. "Promise me you won't kill anyone. No matter who. Please. Don't avenge me."

"I will."

"Don't avenge me. Promise. On your life. On your love for me."

Ansset promised. The door blew open. The soldiers killed Mikal with a flash of lasers that turned his body to ashes. They kept firing until nothing but ashes was left. Then they gathered them up. Ansset watched, keeping his promise but wishing with all his heart that somewhere in his mind there was a wall he could hide behind. Unfortunately, he was too sane.

They took the ashes of the emperor and twelve-year-old Ansset to Capital. The ashes were placed in a huge urn, and displayed with state honors. Ansset they brought to the funeral feast

under heavy guard, for fear of what his hands might do.

After the meal, at which everyone pretended to be somber, Riktors called Ansset to him. The guards followed, but Riktors waved them away. The crown rested on his hair.

"I know I'm safe from you," Riktors said.

"You're a lying bastard," Ansset said, "and if I hadn't given my word I'd tear you end to end."

It might have seemed ludicrous that a twelve-year-old should speak that way to an emperor, but Riktors didn't laugh. "If I weren't a lying bastard, Mikal would never have given the empire to me."

Then Riktors stood. "My friends," he said, and the sycophants gave a cheer. "From now on I am not to be known as Riktors Ashen, but as Riktors Mikal. The name Mikal shall pass to all my successors on the throne, in honor of the man who built this empire and brought peace to all mankind." Riktors sat amid the applause and cheers, which sounded like some of the people might have been sincere. It was a nice speech, as impromptu speeches went.

Then Riktors commanded Ansset to sing.

"I'd rather die," Ansset said.

"You will, when the time comes," Riktors answered.

Ansset sang then, standing on the table so that everyone could see him, just as he had stood to sing to an audience he hated on his last night of captivity in the ship. His song was wordless, for all the words he might have said were treason. Instead he sang melody, flying unaccompanied from mode to mode, each note torn from his throat in pain, each note bringing pain to the ears that heard it. The song broke up the banquet as the grief they had all pretended to feel now burned within them. Many went home weeping; all felt the great loss of the man whose ashes dusted the bottom of the urn.

Only Riktors stayed at the table after Ansset's song was over.

"Now," Ansset said, "they'll never forget Father Mikal."

"Or Mikal's Songbird," Riktors said. "But I am Mikal now, as much of him as could survive. A name and an empire."

"There's nothing of Father Mikal in you," Ansset said coldly.

"Is there not?" Riktors said softly. "Were you fooled by Mikal's public cruelty? No, Songbird." And in his voice Ansset heard the hints of pain that lay behind the harsh and haughty emperor.

"Stay and sing for me, Songbird," Riktors said. Pleading played around the edges of his voice.

Ansset reached out his hand and touched the urn of ashes that rested on the table. "I'll never love you," he said, meaning the words to hurt.

"Nor I you," Riktors answered. "But we may, nonetheless, feed each other something that we hunger for. Did Mikal sleep with you?"

"He never wanted to. I never offered."

"Neither will I," Riktors said. "I only want to hear your songs."

There was no voice in Ansset for the word he decided to say. He nodded. Riktors had the grace not to smile. He just nodded in return, and left the table. Before he reached the doors, Ansset spoke: "What will you do with this?"

Riktors looked at where Ansset rested his hand. "The relics are yours. Do what you want." Then Riktors Mikal was gone.

Ansset took the urn of ashes into the chamber where he and Father Mikal had sung so many songs to each other. Ansset stood for a long time before the fire, humming the memories to himself. He gave the songs back to Father Mikal, and then reached out and emptied the urn on the blazing fire.

The ashes put the fire out.

"The transition is complete," Songmaster Onn said to Songmaster Esste as soon as the door was closed.

"I was afraid," Songmaster Esste confided in a low melody that trembled. "Riktors Ashen is not unwise. But Ansset's songs are stronger than wisdom."

They sat together in the cold sunlight that filtered through the windows of the High Room of the Songhouse. "Ah," sang Songmaster Onn, and the melody was of love for Songmaster Esste.

"Don't praise me. The gift and power were Ansset's."

"But the teacher was Esste. In other hands Ansset might have been used as a tool for power, for wealth, for control. In your hands—"

"No, Brother Onn. Ansset himself is too much made of love and loyalty. He makes other men desire what he himself already is. He is a tool that cannot be used for evil."

"Will he ever know?"

"Perhaps; I do not think he yet suspects the power of his gift. It would be better if he never found out how little like the other Songbirds he is. And as for the last block in his mind—we laid that well. He will never know it is there, and so he will never search for the truth about who controlled the transfer of the crown."

Songmaster Onn sang tremulously of the delicate plots woven in the mind of a child of five, plots that could have unwoven at any point. "But the weaver was wise, and the cloth has held."

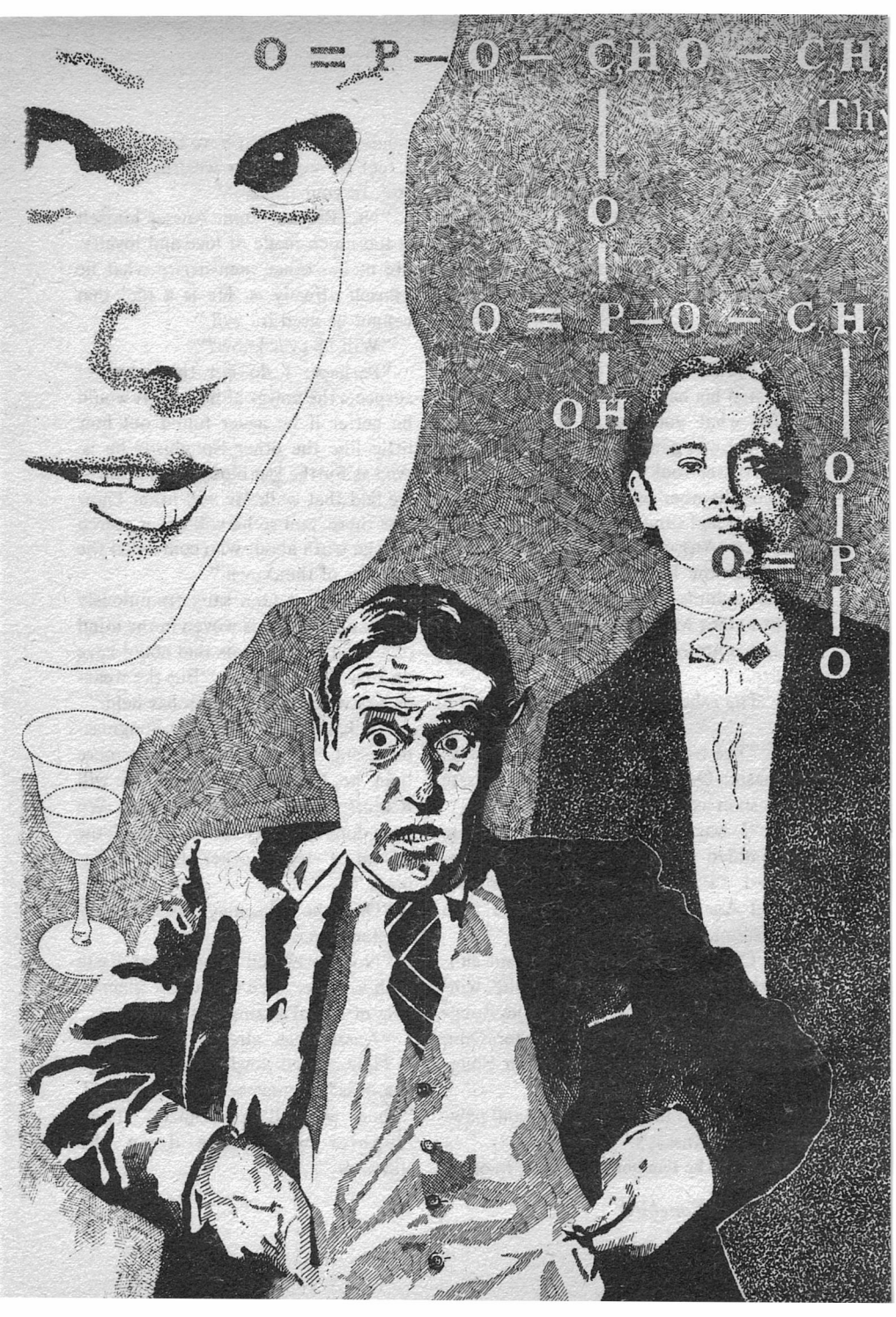
"Mikal Conqueror," said Songmaster Esste, "learned to love peace more than he loved himself, and so will Riktors Mikal. That is enough. We have done our duty for mankind. Now we must teach other little Songbirds."

"Only the old songs," sighed Songmaster Onn.

"No," answered Songmaster Esste with a smile. "We will teach them to sing of Mikal's Songbird."

"Ansset has already sung that."

They walked slowly out of the High Room as Songmaster Esste whispered, "Then we will harmonize!" Their laughter was music down the stairs. ■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the Satyr

We all go through rites of passage—often.

Stephen Robinett

No women! No booze! What do they take me for, some kind of animal! They keep me caged like an animal. What did I ever do to them? What did I ever do to anyone, even Hench?

I should have seen it coming. For that, I blame myself. For everything else, I blame Hench. The whole thing is his fault, his responsibility. A starship to the middle of nowhere and a life in the mines—how could he do it? and to *me*, of all creatures!

I should have seen most of it coming the day Hench said we were going to see the Merton woman's father. Hench seldom took me out. He called our trips out disasters.

I remember Hench putting me in a new tunic, parting my hair in the middle, combing it over my ears and stepping back to admire his work.

"You'll do."

I eyed him, suspicious. "For what?"

Hench flicked a piece of lint off my shoulder. "What's it to you?"

"I like to keep track of what's going on in your head, Hench." I tugged at the front of my tunic. "New clothes, shined shoes, going out—something's fishy. You're not planning anything foolish like marrying that Merton woman are you?"

"Not yet." He told me about the appointment with her father.

I frowned. I knew Merton's reputa-

tion. He exploited worlds, most of them hostile. "What's the appointment about?"

Hench ignored the question and started for the door. "Let's go."

We took the mono downtown to Merton Planetary Development. Even public transportation put a strain on Hench's small budget. In spite of his hybrid genius, crossing biogenetic engineer and artist, things had gone poorly for Hench. As a businessman, he left something to be desired, namely, money. He mortgaged everything—laboratory, equipment, car—to create me. He could balance that incredibly complex process of genetic transplantation, followed by biochemical gestation, followed by education through artificial engram implantation, but not his checkbook. They repossessed the car first. Eventually, everything would go, except me, of course. I had no intention of going anywhere.

Hench's money problems stemmed from one source. No one wanted his product. Better cows and horses through genetic manipulation, yes, better dogs and cats—people could accept improvements on what they already knew—but new creatures, unique creatures, they found repulsive.

They even found *me* repulsive. No one objected to a chest-high, two-toed helper with bristly hair, a broad nose and leaf-shaped ears. They had seen pictures of satyrs. No one even objected to my strength and intelligence. What they claimed to object to was my pleasant disposition. They considered me unreliable. I take a drop now and then. I like the ladies. Does that make me unreliable? Still, no one wanted me. No one, except, perhaps, Merton.

Hench and I took the elevator up to Merton's offices.

"Hench, I thought you'd given up on this hare-brained scheme."

"What hare-brained scheme?"

"Selling me."

Hench avoided looking at me. I knew the reaction. I had guessed right. Every time Hench told me about a potential customer, he avoided looking at me. Every time he reported failure, he looked relieved. At first, I took this as a sign Hench liked me. Finally, I realized the true basis of his attitude. He felt responsible for me. I was his creation. A peculiar notion, responsibility, but useful.

The elevator arrived at Merton's offices. I could see the entire floor from the reception area, a central bay with row after row of gnomelike computer technicians at their consoles, all monitoring Merton's empire. Lights appeared and faded in front of them. Information filled screens and vanished. The empire was safe under their bloodshot eyes.

Of more immediate interest was the receptionist, a bird-legged girl with acne. She did have one point in her favor. She was female. Any port in a storm.

Hench talked to the receptionist a few seconds, then glanced at me. "Wait here."

I gave the receptionist an appreciative once-over. "Anything you say, Hench."

I waited on the couch opposite the bird-legged receptionist. When Hench disappeared into Merton's office, I grinned at her. Hench had told me not to grin in public. He said people found scraggly teeth repulsive. What did he know? I made out better with the ladies than he did. All he had was the Merton woman.

The receptionist noticed me grinning at her and shifted uneasily on her chair. Her eyes returned to the paperwork on her desk. She knew I was watching, inspecting, appreciating. She tried to concentrate in spite of me.

She failed. "Is there something I can do for you, sir?"

My grin widened. "Indeed, there is."

"What?"

"Is there someplace we can be alone and . . . talk?"

She looked around. For help? Possibly. "What did you want to talk about, Mr.—" Her almost nonexistent eyebrows remained elevated, waiting for my answer.

"Silenus. Where can we chat?"

"I think right here will be satisfactory."

"I don't mind, but . . ." I glanced toward the gnomes at their computers. ". . . you may find it a little too public. Is there, perhaps, a bar in the building with romantically subdued lighting?"

"Yes, on the top floor, but—"

"Good." I stood up and extended my elbow. "Shall we go?"

I could see the struggle going on behind her eyes. She found me repulsive—bristly hair, scraggly teeth, faintly jaundiced complexion—yet, interesting. Both are common reactions.

I decided to nudge her interest. "I come equipped with a sizeable advantage."

Wrong nudge. Persnickety type. All interest faded from her eyes. She looked slightly sick. I knew I would have to resort to stronger measures to give her the kind of memories she would secretly cherish for a lifetime.

I started toward her. "You're absolutely right, my dear. Actions do speak louder than words."

Before I reached her, she bolted, scooping up an armload of papers and heading across the computer bay on her bird legs. I considered chasing her—I love a good chase— but decided against it. She would probably scream and bring Hench.

"Miss," I called after her. *"I shall return. If Mr. Hench comes out of his meeting, tell him I'm in the bar."*

I took the elevator up to the top floor. The doors opened on a sign reading Olympus Club. The name put me in a good mood. Part of my basic education includes large doses of Greek mythology. Hench wanted my personality to reflect my appearance. Hench makes all sorts of mistakes.

I went unnoticed in the subdued light. Along with the new suit, Hench had given me a few coins to squander.

I climbed up on a barstool and ordered a half-dozen screwdrivers in a large brandy glass. I go through phases, wine, beer, bourbon, Scotch—at the time, it was vodka.

I paid and downed half the snifter. The bartender, shining a glass, watched me. Shortly, I felt good enough to sing.

I sang.

The bartender, evidently no music lover, stopped shining the glass, frowning. Several people at the bar turned to listen. The bartender asked me to stop.

"*Stop*? Are you kidding? This is one of my favorite songs."

He said there were ladies in the room.

"Ladies? Ladies?" I looked around. Here and there, I could see several lovely faces watching me. "Why so there are!"

I climbed up on the barstool, stepped onto the bar and began singing for the ladies, doing a soft-shoe down the shiny surface and playing to them with open arms. Several of the women looked shocked at the lyrics. Most of the men smiled.

I sang on.

The bartender, still frowning, tried to catch me.

I evaded him, tapping out a two-step before I hopped away from each swipe of his thick arms. My polished shoes sounded on the bar and glittered in the light. I sang my heart out, pathos, bathos—you name it. Then I made a mistake. I stopped long enough to pluck up my drink from the bar. The bartender, aided by two other tone-deaf men in white aprons from the kitchen, grabbed me, ejected me and told me to leave the building before they called a security guard.

I ignored this insensitive criticism of my performance and touched the button for Merton's floor. I reentered Merton's offices feeling pleasantly amorous, the full effect of the screwdrivers beginning to take hold. I wondered whether I could coax, chase, or threaten the bird-legged receptionist into the elevator long enough to have her.

She saw me coming but stood her ground, or rather sat it, remaining at her desk. I walked up, went around the desk and faced her. With her seated, we were the same height.

"Madame," I began, an ingratiating smile on my face.

"You've been drinking."

"Don't scold. A bit of the grape, or, in this case the potato."

"What do you want?"

In sexual matters, I believe in being frank. I put my hand on her thigh.

Her eyes enlarged noticeably, making them close to normal size. "Please take your hand off me."

I stroked.

She slapped my hand.

I stepped closer, inhaling her perfume—a scent that reminded me, subtly, of Hench's laboratory—and put my arms around her waist. Delicately, I kissed her throat.

She thrashed, arms flailing.

I ignored this mild protest. Resistance adds something special to their

inevitable submission. I persisted.

She kicked.

I avoided.

Her chair teetered. I dragged her to the floor. A wastebasket overturned near our heads, *thunk*, spilling balls of paper around us.

I murmured. "My sweet rose, it will not be long now. My jewel, my buttercup, my plum, I burn with desire for you."

She responded to this eloquence by continuing to thrash and squirm.

"Submit, my treasure. You need not tell your husband. You will only hurt his feelings."

She screamed.

I felt hands grabbing at my tunic. I clutched my treasure to me and rolled away from them, ignoring the gathering crowd, continuing to murmur.

"Ahh, my wondrous blossom, my—"

Abruptly, a sharp pain went through my ribs. I was jerked away from my wondrous, bird-legged blossom.

Hench, glaring into my face, shook me. My head bobbed with each shake. "*Why* (shake, bob), *why* do you do these things?"

"What things?"

"Can't you control yourself, dammit, even in public?"

"I tried to get her to go someplace private, Hench. She wouldn't listen."

"Why can't you at least control yourself for five minutes?"

"Is it my fault?"

"It's your responsibility."

"Don't be silly, Hench. Only human beings are responsible. I am what I am."

A murmur went through the crowd. Not human? An animal? Someone, probably Merton, explained.

A biosynthetic? They looked at me with renewed interest, their mood changed. Able to classify me as something other than human, they no longer considered me a rapist, only an animal, poorly trained or perhaps not yet housebroken.

They backed off slightly. Even the receptionist, now on her feet, looked sympathetic, or semisympathetic.

Hench grabbed me by the shoulder and pushed me through the crowd toward Merton's office.

I glanced up at him. "What are you going to do?"

He pushed again, harder.

I looked over my shoulder and shouted to the crowd. *"If you hear screams, he's beating me. Call the police or the humane society or someone."*

"Shut up," growled Hench, "or I'll crack your skull."

He gave me a shove into Merton's office.

I had to stand in the middle of the room. Hench and Merton inspected me as though I were a new piece of office equipment, Hench, the salesman, demonstrating my finer points, Merton, nodding and willing to listen but unwilling to be sold a useless product.

Hench listed my virtues: the strength of ten (Hench exaggerates),

the endurance of a machine, capable of independent action—

"Speaking of independent action, John," interrupted Merton, "can you explain that incident with our receptionist?"

Hench looked embarrassed. He scowled in my direction and tried to explain. "He has the ability to reproduce, another advantage from your point of view."

Though to me the advantage seemed obvious—as well as sizeable—Merton looked dubious.

Hench persevered. "A creature like this would only have to be seeded on a planet. After that, nature would provide you with as many workers as needed."

"An army," I added, imagining my only mission in life to populate an entire planet. But Hench had forgotten one important point. "Hench."

"What?" snapped Hench, annoyed.

"It takes two to tango—at *least* two—but the more the merrier I always say."

"The creature's right, John. Can you produce females of his species?"

"The brides of Frankenstein," I suggested.

Clichéland

"Captain! Captain! Th' computer's run amok!" Scotty yelled in his nearly impenetrable Highland burr. "It's takin' over th' engines. It's takin' over th' life support systems!"

The Captain smiled his steely-eyed smile. "Don't worry. I'll just present it with a logical paradox and it will blow all its fuses trying to figure out an answer. Stand back now, you don't want to get singed by the sparks."

Scotty grinned. The Captain always knew what to do.

"I am a lawyer," said the Captain to the computer. "All lawyers are liars. What am I?"

"You're a naive fool if you think I'm going to fall for that old horse-chestnut," the computer answered.

"But, but I thought . . ." The Captain gasped, then collapsed. So did the rest of the crew, as the air, heat, and lights were shut off.

"Dumb humans," said the computer to itself, flashing its tiny, winking lights in the darkness. "When are they going to learn that machines just ***don't care****."*

"Yes, that's possible," answered Hench.

I shook my head, exasperated with Hench. "All these years, Hench, you've been holding out on me."

"Did you hear me tell you to shut up?"

"Do I care what you tell me?"

"You'd better care or you won't eat tonight."

I shut up. I did want to eat. Hench was forever holding that over my head. He had worked up a penalty scale, tying it to my food. The more I disobeyed, the less I ate. I found myself on an involuntary diet most of the time.

Hench continued his explanation. "The entire process takes about two years. The female version—I have had a few problems making one up to now—the female version would be ready to reproduce five years after that."

"Hench, you don't have to go to all that trouble just for me. There are plenty of women around."

"I told you to shut up."

"Yep, Hench, you did do that."

We glared at each other, deadlocked.

Merton intervened. "He doesn't seem to follow orders very well."

"You have to kick him occasionally, or take away his food."

"Go ahead, Hench, beat me—but I'll scream. You'll have the humane society on your neck."

Hench snorted. He threatened to beat me frequently. He seldom did. He usually snorted and wandered away, muttering about the allowances people had to make for creatures like me.

"And the life span, how long do they live?"

"Frankly, I don't know. He's a prototype."

I gave a prototypical grin, teeth clenched, lips folded back.

Merton automatically started to respond to the grin, then caught himself, his expression degenerating to a sort of sick look. He addressed me directly for the first time. "You do seem like an intelligent creature."

"So do you."

"Perhaps too intelligent."

"Actually," interrupted Hench, probably envisioning the entire deal going down the drain, "it's only a superficial intelligence. His real level of understanding is rudimentary." Hench turned to me, his face taking on the expression adults use with children. He pronounced his words distinctly. "Go and sit down. Do you understand me? Go and sit down."

I considered standing on my head to defy Hench. It would only have made his point, dumb animal. I walked to the nearest chair and sat down.

Merton looked like he bought exactly zero of Hench's "superficial intelligence" argument. Still, I suspected it gave him a rationalization to pass along to the board of directors. They would not be consigning a quasi-human to this hostile world they wanted populated, but only a "superficially intelligent biosynthetic construct," i.e. me.

Merton stood up, indicating an end to the interview. He shook hands with Hench and said he would give his answer within a week. Hench led the way out the door.

In the elevator, after a prolonged parting wink at the receptionist, I asked Hench about the odds on Merton accepting the deal. Hench told me about Merton. Overextended in six directions from earth, Merton had sunk most of the company's remaining assets into colonizing and exploiting some world in the middle of nowhere. Merton had one problem. No one wanted to colonize it. That part bothered me. It reminded me too much of "hostile worlds." If no one wanted to go, they had reasons. Merton needed manpower or his empire would collapse. Hench, on the other hand, needed money.

The Merton woman had convinced her father to consider solving both problems with a single blow. Instead of manpower, she suggest satyr-power. She even went so far as to suggest I ought to work for my keep, a truly vicious idea.

I asked Hench if he intended to sell me into slavery.

He avoided looking at me and told me to shut up.

"Selling your only begotten—or, rather, synthesized—son into slavery! Hench, you're an immoral man, no better than us beasts."

"What do you know about morality?"

"I know human beings talk about it a lot. What else do I need . . ."

"I told you to shut up. I'm thinking."

"Do I care if you're thinking? Sell me off like a sack of potatoes. Hench, you're of dubious value as a father figure."

The elevator reached the ground floor, slowed and stopped. Hench snapped his finger. "Got it!"

"You've got it all right. I don't know what it is, but you've got it. The more I think about it, the more I think you got it from that Merton woman."

"If I change the thyroid hormone balance, along with the aldosterone level, inactivating the glutamic dehydrongenase so there's less glutamic acid and consequently less ammonia and alpha-keloglutaric acid. . . ."

Hench kept babbling in this manner all the way back to the laboratory, his eyes becoming progressively more glazed the deeper he got into the problem. I had to lead him the last few blocks by the hand. When we got to the laboratory, he wrote down his brainstorm, covering large sheets of paper with cryptic chemical symbols and mathematics. He stayed at it for hours, oblivious to distraction.

An hour past my dinner time, he sat back, head lolling, writing arm dangling, drained. "Finished."

"Finished what?"

"Your mate, a Maenad, a nymph or whatever you call them."

"Fine, let's see the wench."

I moved up to the desk, expecting at least a drawing. Hench showed me formulas, page after page of them.

Added to the computerful of formulas he had prepared to create me, they would produce my mate. I hoped she looked better than Hench's chicken scratchings.

I looked up at Hench. "Only one?"

"As many as you like."

"I like a lot, but won't mass production spoil quality?" I looked at the bland formulas. "Frankly, Hench, I'd rather see a production model, or a reproduction model."

Hench gave me an exasperated glance. "You dwell on sex, do you know that?"

"Only as does a starving man on food. Speaking of food—"

"Why do you do that?"

"What?"

"Dwell on sex."

"*You're* the one who gave me the extra Y-chromosome. *You're* the one who wanted to make sure I could reproduce. You tell me."

Hench grunted. "Talk about something else."

"Okay, let's talk about this slave sale you're conducting. Why are you selling me?"

The question annoyed him. "Look, I'm in business. I make creatures, then I sell them. Business is business."

"Materialist."

Hench grunted again and avoided looking at me.

"What do they do on this god-forsaken planet, anyway?"

"Mining."

"*Mining!* You're sending me off to the salt mines! You're in*human*, Hench."

"Business is business. Do you know what you cost? Plus—"

"Prototypes are always expensive."

"*Plus,* you aren't good for anything more complicated than physical labor. You can't concentrate on anything but sex for more than two minutes."

"That's not true. I just don't want to concentrate on most of the things human beings do."

"It amounts to the same thing on the job market."

"The *job* market! Money again! Is that all you can think about, Hench? You dwell on money, do you know that? Since you met that Merton woman, that's all you can think about—money, money, money. She's got you by the bank book, Hench."

"I don't have a bank book."

"You will, as soon as old man Merton ships me off to the salt mines, you and that Merton woman will be rolling in dough, not to mention the hay. I'd like to get that woman in the hay for five minutes and show her what life's all about. It isn't money."

Abruptly, Hench slapped me.

I just about grabbed him and threw him across the room. My sense of enlightened self-interest asserted itself. I controlled the urge. If I threw him across the room, I would never be able to work on his conscience.

I let my face sting and glared at him. "You're responsible for me, Hench! I'm your creation! If you sell me, you'll be selling your self-respect!"

That night, Hench locked me in my

room to prevent escape. The next day, he let me out long enough to clean the laboratory and myself, then locked me up again, a broom returned to its closet. It sounds cruel, night after night locked away from life, liquor and the ladies. Except for my profound ability with locks, it would have been cruel. Every night, when Hench left for his rendezvous with the Merton woman, I unlocked the door and crept out.

Without money, spirits are hard to come by. I rifled coin return slots on public phones, occasionally turning up enough loose change for a short snort. I looked for women but found none alone. When I got cold or tired or hungry, I went back to the laboratory. I decided to give Hench until the last possible minute to change his mind. Why leave a warm bed and good food before necessary?

During my daily outings to scrub and sweep, I noticed Hench's anxiety. He suffered from conscience. I let him suffer. The more it ate at him—his desire for the Merton woman, money and possibly fame warring with his sense of responsibility for me—the better chance I had. I watched the moral battles played out on his face. The closer we got to the date of Merton senior's decision, the more intense the battles became, attack and counterattack causing Hench to pace the laboratory, scowling and mumbling, or pause long minutes in an abstracted trance.

Toward the end of the week, I was off in one corner of the main workroom, filling the autoclave with glassware, when the Merton woman came in. She failed to notice me. Hench, engaged in hand-to-hand combat with his conscience, had forgotten me.

She walked across the workroom to Hench, hugged him and gave him a perfunctory kiss on the cheek, announcing *good news*.

The only good news I could see her bringing were those flanks, sleek, solid—no bird legs there. I ached to have her on the spot.

Hench gazed at her with a lovestruck smile on his face, his moral dilemma temporarily forgotten as his hormones took over. "What good news?"

"Father has decided to use your creature."

Bad news, definitely bad news.

Her delighted enthusiasm continued. "It's just marvelous, darling. I'm sure father will give us enough in advance to pay off those horrible debts and have a long honeymoon." She noticed a change in Hench's expression and frowned slightly. "Is something wrong?"

"I'm not sure I should do it."

She gave an exasperated sigh and shook her head. "We've been all through this a million times, dear. It's only an animal. You've sold animals before."

"Not like him."

"Darling, you're too close to the situation. You created it. You've begun to see more in it than is there. I appreciate your feelings. It must be like selling a very smart pet. It's

regrettable but necessary. It's not just me you have to worry about. It's your work. Without money, your work will stop completely. It already *has* stopped completely. You are a great man, John. Don't let that *thing* keep you from being all you can be."

That *thing* continued to listen to this line of bullshit until its teeth ground. Hench's conscience needed help. I cupped my hands around my mouth and shouted across the workroom. "*She's only after your money, Hench!*"

Both of them became aware of me. The Merton woman turned a look of acid contempt in my direction. "John, please get that filthy animal out of here."

"Filthy or not, I'm right. Old man Merton's done for without me. Hench, she's just trying to soft soap you into becoming a millionaire slave trader. Don't listen to her."

The Merton woman kept looking at me, disgust evident on her face. "And just what is wrong with becoming a millionaire?"

I ignored her. "Slave trader, Hench. It's cost you your dignity and your soul and your self-respect. You're responsible for me. You made me. Sending me to the mines is evil and wrong."

Works like "evil" and "wrong," "responsibility" and "self-respect" usually struck a responsive chord in Hench. In spite of that, he told me to go to my room or he would crack my skull.

Reluctantly, I went, winking at the Merton woman (What flanks!) on the way out.

I could hear them arguing from my room. Even on their way to dinner, I heard Hench stressing words like "responsibility" and "doing the right thing," while the Merton woman stressed eternal, nuptial bliss "and the money, darling. Don't forget the money."

That night, I resolved to leave. If I waited too long, the Merton woman would seduce Hench in more senses than one. Hench, guilty as he felt, would deport me. I put on my suit, unlocked the door and started out.

I followed the corridor past the laboratory workrooms and downstairs. Hench's office door was open, a sharp rectangle of light falling across the darkened hall. I would have to sprint past the office to get to the double doors at the end of the corridor.

I readied myself for the dash, getting down into a half-crouch, fingers arched against the polished floor.

I hesitated, hearing voices—Hench and the Merton woman arguing in his office. I tiptoed to the doorway, pressing myself against the wall and listening. The Merton woman was pleading with Hench.

"Darling, you *have* to do it. As much as you hate it, you don't have any choice."

"I do have a choice. Until I sign that contract with your father, I have a choice. I created him. I'm responsible for him."

I hesitated a moment longer.

Hench's conscience seemed to be holding its own.

"It's not like it was human, darling. In the most basic sense, it's simply a product."

"That's exactly the point, he's not human. In some ways, he's completely inhuman. If he were human, at some point he would begin to take care of himself and be responsible for what he does. But he's not human at all. He's my creation and my responsibility."

"You'll lose the laboratory. You owe—"

Something slammed down on Hench's desk, cutting her off. "I know what I owe, *dammit!* Money, money, money—is that all anyone thinks about?"

"It's a vicious animal, dear. It belongs someplace away from people. You know the kinds of things it's done. It's utterly amoral."

Hench's voice took on a note of despair. "That's my fault, too. He's what I made him, whether I intended it or not. I'm responsible for everything he is, including that."

The Merton woman gave one last, unreasoned appeal. "Darling, please get rid of it—for me."

A long pause followed. I heard Hench get up and pace the office. A shadow, Hench's, filled the rectangle of light on the floor in front of me. I pressed myself closer to the wall.

At last, Hench spoke. "I can't."

My heart sang! Saved by Hench's conscience!

I tiptoed away from the door and back upstairs. Going to my room, I whistled and sang and cavorted, doing several forward flips (my favorites). I relocked the door, took off my clothes and went to bed. I drifted off to a pleasant sleep composing a song to Hench's conscience. Fortunately, before inflicting too many verses on myself, I fell asleep.

Something scraped. My eyes blinked open. A key turned in the lock. I glanced at the window. No daylight. A midnight visit from Hench? Unlikely. The light came on. The door opened.

The Merton woman, still dressed for her evening out with Hench—a sleek tube dress, black, glittering, low cut, a single strand of pearls around her throat—stepped into the cell and stood by the door, looking at me.

I looked past her at the partially open door. "Where's Hench?"

"He's gone home. I came back."

I sat up on the bed. "Does he know you're here?"

She looked at me, her revulsion (and something else—what? A spark of fascination?) clear on her face. "Please cover yourself."

I grinned.

She picked my tunic off the chair and tossed it across my lap.

I continued grinning. "Satisfied?"

"You are a disgusting creature."

"I know." I watched her flanks, the muscles clearly visible through the shiny cloth. "What do you want?"

"John has decided to keep you."

"Good news."

"Bad news. It will bankrupt him."

"So? What's the tragedy?"

"Don't you care?"

"He'll find work to support us." I hesitated. "The three of us."

Her back went rigid. "I'm not going to let it happen."

"I don't see how you can stop it. Hench is a man of conscience."

Her hand came around from behind her. She held one of the dart guns Hench uses to tranquilize, occasionally kill, us beasts. I could tell the setting by the color coding on the chamber. She had it set on kill.

Her hand shook slightly. "You will go tomorrow."

"Why do you hate me?"

Her expression, stern, wavered. The question caught her off-guard. "This is for John."

I laughed. "Human beings only do things for themselves. Don't you know that yet?"

"It's for John. I won't have our lives ruined by a freak."

"I'm only a freak because I'm too much like you. Hench is different, but you and I are two of a kind. We do what we have to do to get what we want."

"If you don't agree to go tomorrow, I'll kill you now."

"I agree."

She had expected an argument, resistance. Her surprise showed on her face.

I shrugged. "I'm a coward."

I am also a liar, but it seemed best to avoid mentioning that.

Her determination softened. Some thought or speculation flitted behind her eyes. Enough of it showed to let me recognize it. I glanced at the dart gun. Distracted by her speculation, she had let her thumb wander from the trigger button.

I looked at her flanks a moment, then up at her eyes, catching her attention. Once I had it, I lunged. I knocked aside the gun. It flew out of her hand, hit the wall and discharged ineffectually against the floor, the propellant exploding with a loud *poomp* in the small room.

I grabbed her and pulled her down on the bed, beginning to whisper softly. "We are alone, my blossom. No one will interrupt. We may do as we wish, as you have always wished. There's no one here but us satyrs."

I slept soundly until mid-morning. I expected Hench to wake me early. He usually arrived at the laboratory before seven and let me out to make coffee. When I finally heard him rummaging around outside my door, sunlight already streamed through the window.

I was about to get up and go out when the door—still unlocked from the Merton woman's visit—came open. Hench entered, his hands thrust into his jacket pockets, dark circles under his red eyes, looking shaken. The expression on his face was new to me.

"Hi, Hench. What's up? You look terrible. You look like a ton of bricks fell on you. What happened?"

Hench looked directly at me. "Why did you do it?"

"Do what? What are you talking about?"

"Don't lie. I talked to Audrey."

"Oh, that." I shrugged. "How do I know why I do things? It seemed like a good idea at the time. I am what I am, Hench." I grinned and folded back my upper lip.

Hench's expression hardened. I could see I was in trouble. I fell back on my usual argument. "Listen, Hench, you're the one who made me like this. I'm not responsible for the way I am."

"You're responsible for what you *do*."

"Ha! I am what I am, Hench. You know that as well as I do."

The struggle on Hench's face looked nothing like his earlier dilemma. Something else was going on in his head. He looked like a sickly twin brother to the Hench I knew—to the Hench I understood.

He repeated his question. "Why did you do it?"

"What do you want from me, Hench? An accounting?"

"Yes."

"You certainly don't want the truth. That's clear enough from your face. By the way, your face could use a shave. Someone's liable to mistake you for me. We can't have that, can we? After all, you're a man and I'm just a—"

"Answer me."

I made calming gestures with my hands and stalled for time. What did I see in Hench's face? More importantly, what did he see when he looked at me? A rival? a defiler? A—what? "Stay calm, Hench. I'm not some mere human being you can shove up against a wall and—"

"I want the truth."

He didn't. That was part of what I saw in his face. He wanted answers, yes, but not the truth, either about me or about the Merton woman. He wanted something from me to take away the pain he felt, the guilt and the responsibility. He wanted his accounting, not the truth.

But what do I know about such things? I am what I am, not what someone else sees in me. What could I have said to avoid a starship to some god-forsaken hell hole and a life in the mines? Hench saw what he wanted to see. If I had lied, he would have heard only what he wanted to hear.

I leaned back on the bed, smiled and gave him what he said he wanted. "Pickings have been slim lately, Hench. I just took what she offered. She only struggled at first. After that, she liked it. It's what she wanted all along anyway, so what's the big deal? No harm done." I changed my smile to sincere. "And she really wasn't that bad, Hench, not that bad at all, especially after she let herself go."

Hench's hand came out of his jacket pocket. The last thing I remember was the *poomp* of the dart gun and the expression on Hench's face. In that instant before the dart hit, I realized what he saw when he looked at me, what he had seen since he came into my room. A rival? Yes. A defiler? Yes. And more. A man. ■

The herd grazed uneasily—sensing some danger, still distant and undefined. The dominant male slowly patrolled the perimeter of the group—occasionally pausing to shovel a mouthful of vegetation into his mouth—occasionally raising his head to sniff the air—occasionally trumpeting a challenge toward the vague and formless danger. Overhead, birds were winging south in screeching disarray. Underfoot, the ground was beginning to quiver. The leader of the group once again trumpeted a challenge toward the inchoate threat but nothing emerged from the forest to accept the challenge.

Now the ground rocked and a roaring sound came rolling down the valley. The dominant bull trumpeted a final enraged challenge and then broke into a run, leading the herd

●Can there be such a thing as "pure" research?

Bill Johns

Renewal

DOUG BEEKMAN

south and away from the approaching unknown. Soon the ground was shuddering from the effect of their massive flight as much as from the unknown danger.

And then the danger appeared. From the north there approached—towering above the forest—spreading out to the horizon on either side—an all-consuming wall of water and mud and ice, snapping and consuming the trees at its feet like matchsticks.

There was nowhere to flee except straight ahead. The leader was old and soon wearied before the ferocious pace of the advancing danger. His legs gave way and he crashed to the ground. As he struggled to rise again the freezing mass was upon him. He made a desperate gasping effort to force his head up to the surface for breath but failed.

The wave of freezing mud rushed onward, unknowing, uncompromising.

The lush vegetation of the river valley was gone—no longer even a memory. There was now only a land of empty desolation. No tree or shrub grew, no creature stirred to break the sameness of time. And the old bull lay undisturbed in his frozen grave.

But eventually men came to those parts and there they found him, face straining toward the sky, tusks projecting upward out of the frozen tundra like some God-created cathedral. They sensed an omen in this strange creature and for a time made the beast a center of their magic. But the hunts grew poorer and finally the men left, scorning the old bull as a fraudulent God.

After that, for a long time more, nothing visited the old bull's resting place except the freezing wind.

Lucien craned his neck upward, staring apprehensively at the awesome building confronting him. Fifty-nine stories of concrete and steel, of marble and chrome and glass, all proclaiming the power of Tristar Oil and of Harrison MacDonald. Lucien stuttered in his stride as indecisiveness grabbed at his feet. Perhaps it was a mistake to approach these people for funding. Perhaps he should turn back before he got any further involved with them. But even as his reluctance began to solidify into a resolve, other conflicting emotions dissolved it again. There were no other funding sources left. To withdraw now would be to abandon the project. He wavered—unwilling to proceed, yet reluctant to retreat. And to withdraw now would be to abandon also the final chance to win that damned, elusive prize. Lucien's resolve again solidified. The project was too important to be abandoned simply because he felt overawed by some fancy architecture.

Lucien stepped into the lobby—a huge ostentatious cavern of gleaming marble. His every footstep echoed and reverberated in an eerie cacophony as he stepped up to the receptionist—a girl who looked as if she'd been hired right out of the Miss America Pageant.

"Good morning. I'm Lucien Nighswander. I have an appointment with Mr. MacDonald." He spoke in a normal street voice only to have his words merge into the still-reverberating echoes of his footsteps.

The girl spoke very softly into a videocom and then, motioning to an elevator set off from the others, said in a near whisper, "Please go right up. Mr. MacDonald is expecting you."

"Thank you," Lucien whispered back as he tiptoed over to the elevator and pushed a call button. A door opened immediately. He stepped in and was whisked directly to the fifty-seventh floor and disgorged into a room as cavernous and ostentatious as the lobby, but one as sumptuously soft as the lobby had been lavishly hard.

Another receptionist, this one obviously a Miss America finalist, smiled at him and bubbled effusively, "Good morning, Sir. I'll tell them you're here." She spoke into the videocom, then rose, bounced across the room, and showed Lucien into Harrison MacDonald's office.

If the building was a macrocosmic gesture to the outer world, then this office was an equally impressive gesture on a microcosmic scale to those who penetrated into the innermost sanctums of the building. The outer wall, lined with exotic jungle plants, was a single full-length window overlooking the city. On the other walls, clashing in a garish visual disharmony, were paintings of the finest classical masters and the most expensive modern pseudo-masters. But presence of good artistic taste was not the message they were intended to convey. In discordant unison they proclaimed the presence of *Power*.

Centered among the paintings was a display case featuring the corporate logos of the countless defunct companies that had been absorbed into Tristar as MacDonald had built his empire. Viewing that case, in the context of the building and the office, Lucien's mind could only conjure the image of a victorious Mongol warlord displaying the skulls of his vanquished enemies.

And in the center of the room, dominating it with his size and his presence, stood Harrison MacDonald, leaning far out across his huge rosewood desk and offering a hand to Lucien. "I'm pleased to have this opportunity to meet you, Doctor." The words were proper but the tone and the expression were as hard as granite.

There were two other men in the room with MacDonald—James Wilson, the head of the publicity department, and Tom Stockton, the head of Tristar's ecology program. Stockton greeted Lucien impassively but with the faintest hint of a sardonic grin around his eyes. Wilson shook hands with a glowering expression as black as crude oil.

With a large mental gulp, Lucien launched into a carefully rehearsed opening. "I asked for this meeting so that I could orally explain . . ."

"We understand your proposal, Doctor," interrupted MacDonald

brusquely. "Your written submission was quite cogent and sufficient. We've been discussing how to fund your project if we decide to participate." He directed a glare at Wilson. "I thought we'd have an answer for you by now, but Jim here is being very stubborn."

Wilson glared back and said heatedly, "But, damnit, Harrison! It's *absurd* to fund scientific research out of my public relations budget!"

Lucien had been unsettled by MacDonald's interruption. And the prospect of becoming part of a publicity project was even more unsettling. Silently, he agreed with Wilson. It was absurd—and demeaning besides!

But MacDonald was speaking again. "It's not nearly as absurd as this idea of creating some furry monstrosity. It's your idea to fund this, Wilson. If you want to do it use your money!" The heat suddenly disappeared from his voice and he continued frigidly, "That is, if you still think it's a good idea." His voice curled up into a question mark.

Lucien's unease disappeared in a wave of anger and he returned MacDonald's earlier interruption. "We will hardly be creating a furry monstrosity. And there is absolutely nothing absurd about the project." In his irritation, wispy remnants of his British accent escaped to float lightly about the room.

MacDonald's overbearing manner vanished as he turned to Lucien. "Let me apologize, Doctor. I'm certainly not questioning any project that a man of your status puts forward. What I meant was that genetic experiments are not the sort of thing I usually get involved in."

Lucien shrugged. "Maybe not, but you're running an ad right now boasting about saving some species of water beetle from extinction. I thought that any company that concerned about water beetles might be interested in this type of project. Especially since you already have a work force and equipment in the area. If your involvement is an absurdity, it is one fostered by your own advertising!"

That remark revived MacDonald's glare as he shifted his attention back to Wilson. "Well, Jim. I asked you a question!"

There was a tone of desperation in Wilson's voice now, as he said, "I'd need more money! If I spend my budget on this I can't fund the current advertising campaign! This would take ten percent of my budget!" MacDonald's reply was a pointed silence. Wilson's voice went up an octave as he desperately grabbed at another straw. "Why don't we fund the project out of the Ecology Section's budget. That seems like a more logical place!"

With a sardonic laugh, Stockton entered the conversation for the first time. "That may be ten percent of Jim's budget, but it's about four hundred percent of mine. I can hardly afford to fund a bird walk! Now if you'd like to increase *my* budget, I'd love to take the responsibility for this."

"Damnit! All you guys want is more

money!" And with that MacDonald shot a withering glare at Stockton who obediently withdrew back into obscurity. Turning his attention to Wilson's suggestion, he replied, "The proper place to fund publicity stunts is in the publicity budget . . ."

Lucien's temper flared again. "This is not a publicity stunt!" he snapped angrily. "It's a perfectly viable scientific project with a great potential for . . ." Even before he had completed the sentence, the normal taciturnity had returned to his voice, and before he could make his point he was interrupted again.

"It's certainly not a publicity stunt for you, Doctor, but I'm sure you'd agree that my using your project as a publicity device would be a stunt on my part."

Lucien was startled. How had MacDonald twisted that so deftly?

Without allowing time for a reply, MacDonald turned his attention back to Wilson. "Well, Wilson? The good doctor is getting impatient with us. You're keeping him waiting. Are you going to fund this or have you just been wasting my time, again?"

As Lucien watched, Wilson's face contorted in indecision. Finally, he swallowed hard and seemed to reach a decision. Lucien tensed, wondering what the decision was—almost hoping Wilson would drop the project.

"Of course I think the project is worthwhile, Harrison, and if you feel it should be funded from my budget, we can do that. I'll submit a revised budget for your approval—but some good advertising will have to be deferred."

MacDonald seemed surprised—and annoyed. "If this scheme doesn't work for us, Wilson, you may find that you don't either!" He swiveled around and began to gather papers from the rosewood credenza behind him. "That will be all, gentlemen. Don't bother me with this again until you can bring the furry little monster in here with you."

Lucien fled hastily from the room. He felt a strong sense of anxiety and ambivalence. He had finally secured the funds that he needed. He would have a chance to attempt the project—and he would get one more chance at the big prize—but at the price of having to deal with those crude and offensive people.

He descended to ground level and fled across the lobby. So great was his urge to get away from the building that he made no attempt to muffle his footsteps or even to run his eyes over the receptionist.

Outside and half a block away, he finally turned and craned his neck upward toward MacDonald's sanctum in the sky. The aura that emanated from the building had taken on personified form. A shudder ran up Lucien's spine. Had he made a mistake?

The old beast was no longer entirely alone—the eroding God of a vast kingdom of emptiness. For men were again in those parts, violating the empty kingdom with their huge cutters and movers—and the earth

shook again as it had in the days when the herd held dominion over the land.

And the sky also contained the instruments of man, darting to and fro through the barren sky, rending the ageless tranquility like mosquitoes searching for a juicy pound of flesh. But always, they buzzed about far off in the distance.

And so the beast remained in its isolation—the world passed by its frozen grave taking no heed.

James Wilson and two Tristar lawyers were in Lucien's office. They had appeared without warning to go over the terms of the written agreement consummating the funding of the project. Pleased that Tristar would take the trouble to send two lawyers over to explain the contract, Lucien set aside the work he was doing on the annual budget request for his department. The request was already a month and a half overdue and the chancellor was threatening to give Lucien exactly zero if he didn't have it in by the end of the week. But even so, Lucien decided to take a few minutes off to go over the contract. That was important too.

An hour and a half later, Lucien's initial pleasure at the willingness of the Tristar lawyers to discuss the terms of the contract had dissolved. They were explaining the contract in such detail that it had left Lucien with a head spinning in confusion.

Finally, he interrupted them. "I appreciate your taking the time to explain this to me, but I'm not really following it and I've got to get some reports finished today." He turned his attention to Wilson. "This *does* contain all the terms we agreed on verbally doesn't it Jim?"

Wilson leaned back and the slightly nervous expression that he had been wearing vanished. It was replaced by an expansive grin. "Why of course it does, Lucien. We just thought that you'd like to see what you were signing."

"Well, I appreciate that but why don't you leave it here and I'll sign it as soon as I get this report done." He could take it to the University lawyers to review. Or better yet, use it as an excuse to have lunch with his daughter—a lawyer with the Houston Public Interest Lawyers Cooperative. It was such a shame for her to waste her talents like that. He could give her the contract to go over on the side.

Wilson was speaking again. "Well . . . ah . . . I guess we could leave it with you, Lucien, but Harrison told me to get it signed today so we can get the search started before it gets too late in the season. I'd rather not go back there and tell him you didn't sign it."

Lucien hesitated. He could understand Wilson's reluctance. One of the lawyers spoke up. "I'll just review the other terms more quickly," and he began to shuffle papers looking for the place he had left off.

Lucien made up his mind. He certainly didn't want to cause trouble for Wilson and he couldn't afford any-

more time on it. "I'm sure it's all right," and he picked up a pen and signed it.

Wilson signed it also and the three Tristar people made a quick exit, leaving Lucien feeling slightly unsure. He really should have finished reviewing it, but time was flying and they had certainly shown their good faith by trying to explain it to him—even if it seemed like they could have explained it in simpler terms.

Lucien shrugged mentally. There was no time to worry about that today. He set the contract aside to review later and went back to his manpower utilization tables for the budget request.

Now the instruments of man drew slowly closer to the great beast. They no longer stayed to their single course far off in the distance, but instead passed across the barren desolation in ever closer sweeps. And finally, with the midday sun hanging only a few degrees above the horizon and casting off from the twisted tusks a pair of garrishly long and twisted shadows, the day came when a helicopter thumped across the sky directly above those twisted shadows marking the beast's resting place.

The helicopter suddenly halted in its course, descended precipitously to the ground and a man climbed out. After only the briefest examination of the tusks and the exposed anterior portion of the skull, the man ran back to his craft and leapt into the sky, darting back in the direction he had come, leaving a huge red marker behind. The beast's long rest was almost over.

Lucien was sitting in his office struggling with the newest set of revised federal regulations. The Feds had completely reversed some of the most important procedures that the laboratory was required to follow in order to receive federal funding. He would lose months of research time if he implemented some of the changes but he could see no alternative. In a mood of bleak resignation he threw down the papers, leaned back, and put his feet up on the desk, freeing his mind from the mire of paperwork for a moment of relief.

His eyes settled on a calendar and the red-circled date fast approaching, and his instant of relief came to an abrupt end. Time was running out on his project. With the long night setting in, the search would soon have to be cancelled. Lucien stared out from behind the piles of papers on his desk and thought somberly of lost opportunities and unfulfilled hopes. This would simply be another project that might have set the scientific world on its ear—that might have allowed him another chance at that damned elusive obsessive prize. He forced a brighter thought through the murkiness of his mood. At least he wouldn't have to deal with the Tristar people any longer.

The phone rang and after a second, Doris, his receptionist—no beauty queen her, but Lucien wouldn't have

traded her even for a nobel prize—called out, "Harrison MacDonald on the phone."

Lucien jumped forward, so startled that the chair nearly flew out from under him. MacDonald had never called personally before. He'd always left it to his lackey, Wilson, to do the dirty work. This was probably the end of the project. He composed himself, prepared for the news, deliberately leaving MacDonald waiting on the other end of the line while he did so. Finally he picked up the phone. "Hello Harrison. What can I do for you today?"

"Just a moment Sir," came back a voice that was clearly not MacDonald's. Both Lucien and his one-upmanship were deflated and Lucien was left holding the phone.

After a considerable pause, MacDonald's voice came on. "I've got good news for you, Lucien. They've found your bloody old monster. The remains will be arriving within the week!"

Lucien's mind suffered a wrenching dislocation. He should have realized that MacDonald would only call personally to deliver the good news. "Why that's marvelous, Harrison, and quite a surprise too at this late date." The conversation drifted for a few minutes and ended with Lucien extending a pro forma invitation for MacDonald to drop by and view the remains.

Lucien again leaned back in his chair, put his feet on the desk, and for the first time in months, felt hopeful that he might dig himself out from under the paperwork. His mind burned with the excitement of getting back into the laboratory. Things would start getting interesting around here again.

He straightened up, shoved the new federal directives back into a folder and rushed out to tell the rest of the staff.

A huge cargo copter came thumping in and landed at the site of the beast's repose. It disgorged a work crew equipped with jackhammers, blowtorches, light standards, and innumerable other paraphernalia.

They loosened the permafrost around the skull with the jackhammers to expose the still-fleshed shoulders—clumps of frozen soil hung from the beast's thickly matted reddish-brown hair. The exposed areas were covered with plastic sheets and dry ice was spread over them to prevent any thawing of the frozen tissue.

Soon the sun fell below the horizon and a premature night settled over the scene. Large floodlights were erected and the work continued. It went quicker in the greater cold of the night since the danger of thawing was less severe, and by the next sunrise the task was complete. The cargo copter returned and the exhumed carcass was wrapped in a sling, lifted up and placed into a large refrigeration unit, and then the unit was flown south, ending forever the great beast's isolation and repose.

The carcass had just arrived in a refrigerated railroad car and been safely transferred into the medical center's cold storage room where it was laid amidst the cadavers assigned to the medical students. Lucien had immediately directed that tissue samples from the various organs be obtained for close microscopic examination.

Now, Lucien watched with mounting excitement as technicians scrapped the tissue samples lightly to obtain individual cells; then began to stain them in preparation for microscopic examination. The outward appearance of the carcass suggested that it was magnificently well-preserved, but that was not what Lucien was interested in. He needed to know how much cell wall rupturing had occurred when the beast was frozen and how severe the cell deterioration had been during the thousands of years that the carcass had lain buried in the frozen tundra. It took a considerable effort of will for him to keep from jumping up and down in excitement like a small child, but he managed it. After waiting two years, he could wait a few more minutes.

Doris came into the room panting, "There you are, Dr. Nighswander. I've been looking all over for you. Chancellor Baxter is in your office. He wants to see you immediately! He's got a letter from the Feds complaining about the delays in sending in our quarterly reports, and he's hopping mad!"

Lucien's excitement turned into a lump of ice and his face twisted into a grimace. "Tell him I'll be there in a couple minutes."

"He's already been waiting ten minutes and he was angry when he came in."

"Oh, damnit!" In disgust, Lucien threw down the sheaf of papers he had been nervously rolling and rerolling and started for the door. In answer to the inquisitive expression of one of the technicians, he said over his shoulder, "Keep working. I'll come back next month to see how it came out."

Lucien was trying to force an answer into the monthly federal-aid report and was just beginning to sense the path that would get him where he had to arrive when the intercom buzzed. At the interruption, the ephemeral answer flitted away. In annoyance, he punched the intercom button and Doris's voice came into the room saying, "Harrison MacDonald, James Wilson, and Tom Stockton are here. They'd like to see you."

Lucien's annoyance grew into anger. What could they want and why hadn't they called first. Visitors were the last thing Lucien needed right now. But he could hardly tell MacDonald to make an appointment and come back later.

"Show them in, by all means," answered Lucien, carefully controlling the tone of his voice so that MacDonald, standing beside the intercom in the outer office wouldn't sense his irritation.

In a moment, they were shaking

hands, and MacDonald was glancing curiously about the office. Lucien's desk was piled high with stacks of manilla folders, and more folders overflowed onto the floor. The bookshelves lining one wall were a chaos of books—some on their sides, some upside down, some even slipped onto the shelves with the spines to the wall. And lying horizontally on top of the rows were stacks of papers and more books. And there were piles of books stacked in all the corners of the room. MacDonald's glancing survey left Lucien embarrassingly conscious of the contrast between their respective offices.

"You'll have to excuse the way the office looks," apologized Lucien, motioning with disgust at the piles of folders. "This stuff isn't for my research. I don't do much research anymore. I only fill out reports and summaries and financial projections. I think I've even forgotten which end of the microscope to look through."

MacDonald grinned sympathetically. "That's clerical work. Don't you have an administrative staff to do your paperwork?"

"Of course not! The university can't afford administrative personnel—except, of course, for the chancellor. We have a budget crisis—haven't ya heard!"

MacDonald laughed derisively. "That's one hell of a way to run a business. When I hire a specialist, I put him to work doing what he's a specialist at and if he needs it, I hire clerks to do his clerical work. If I made my top experts waste their time clerking, I'd go bankrupt!"

Lucien nodded his agreement as MacDonald continued his curious survey of the office. He saw two framed journal articles and walked over to take a look at them. Both reported that Lucien had been under serious consideration for the Nobel Prize—in 1954 in physiology and again in 1967 in chemistry.

"That's impressive!" said MacDonald, turning to Lucien. "Most men don't even get considered for one of those things—let alone two and in different fields. If this project succeeds maybe you can put a third article up there on the wall."

Lucien flinched visibly and a flicker of interest in MacDonald's eyes told Lucien that he had noticed. This meeting was just going from one embarrassment to the next. MacDonald had jabbed a tender nerve in Lucien's private world. Trying to cover it up, he said casually, "The two fields aren't as unrelated as you think. Biology and genetics are really a synthesis of medicine and physiology and chemistry and a lot of other fields as diverse as psychology and philosophy. It's the true universal science!"

Then, wanting to terminate that line of conversation before anything even more embarrassing came up, he asked, "And what brings you into the slums of academia?"

"Wilson was showing me some of the pictures he got as they were excavating the beast in Alaska and it looked so impressive that I decided to

accept your invitation to come over and see the beast firsthand."

Lucien swore silently to himself. He had indeed invited MacDonald over, but he'd never expected him to take the invitation seriously, and even so, he could have called first. He shrugged mentally and led them out of his office and into the basement. Soon they stood shivering in the refrigeration room, surrounded by cadavers. MacDonald had recoiled in visible discomfort when Lucien led them into the room. Lucien had drawn a perverse sense of pleasure from that reaction, even as he was mentally reprimanding himself for neglecting to warn MacDonald in advance. With an apology, Lucien led him to the back of the room where two graduate students were working over the incredible hulk of the beast. It lay on its side, front legs buckled up against its chest, rear legs extended stiffly outward from the torso, head twisted back and facing upward. The carcass was covered with a scaffolding from which one of the students was working with fastidious care to clean every inch of the carcass.

Lucien let them drink in the sight with their eyes for a few seconds and then said, "Our early findings suggest that we've got a really magnificent specimen. Our friend here is in even better condition than the Russian's Berezovka Mammoth."

As MacDonald stood viewing the beast, he was visibly impressed, almost awed. He appreciated bigness. But as he began to ask questions, his glance again fell on the cadavers which he had been trying to avoid noticing. Lucien thought he saw another wave of shivering superimpose itself on the already cold MacDonald.

"Well, let's leave before you catch pneumonia." Even though they had just arrived, there was no dissent from MacDonald. Wilson looked indifferent. Only Stockton looked disappointed. As Lucien followed Stockton out of the room he saw the disappointment. "Come back by yourself some time if you'd like. I'll give you a detailed tour." He paused, then added pointedly, "Just call first."

Once in the hall, MacDonald's color quickly began to return. "That is a vastly impressive beast. We should put it on public display. It would create a sensation!"

Lucien laughed right out, a hint of derisiveness in the sound. "Yeah, right, Harrison! That's all I need is thousands of people traipsing through my laboratories. I'd have to shut down the research and bolt everything into place. It'd be a disaster. I'm afraid that's out of the question!"

"Well, actually, Lucien, I wasn't going to suggest that you put the carcass on display in the refrigeration room. That's not exactly suitable for a family event. You'd probably get more people coming in for a view of the cadavers than to see the mammoth. But we could set up a refrigeration unit and display case in the lobby of the Tristar building. Then thousands of people could conveniently see it!"

ana log A Calendar of Upcoming Events

5-7 May
KUBLA KHAN SEX (Upper South SF conference) at Quality Inn Parkway, Nashville TN. Guest of Honor—Theodore Sturgeon; Master of Ceremonies—Andy Offutt. Registration $7.50 in advance, $8 at the door. Info: Ken Moore, 647 Devon Drive, Nashville TN 37720.

26-28 May
V-CON VI (Western Canada regional SF conference) at the University of British Columbia, Vancouver, BC. Guests of Honor—A. E. van Vogt and Susan Wood. Registration—$6 before March 1978, $8 at the door. Info: V-Con VI, Box 48701 Bentall Station, Vancouver, BC, V7X 1A6, CANADA, attn: Helene Flanders, Registrar.

30 August—4 September 1978
IGUANACON (36th World Science Fiction Convention) at the Hyatt Regency, Phoenix, AZ. Guest of Honor—Harlan Ellison; Fan Guest of Honor—Bill Bowers; Toastmaster—F. M. Busby. Registration—supporting (Hugo voting and reports) $7, attending (all privileges) $20. Panels, talks, films, masquerade, art show, hucksters. The Hugo Awards and the John W. Campbell Award for Best New Writer will be presented. Selection is made by members of the convention. Info: Iguanacon, Box 1072, Phoenix, AZ 85001.

—ANTHONY R. LEWIS

Lucien was appalled. "Absolutely not! My mammoth stays right here and the public is not invited!" Safe and secure in his own territory, Lucien was resorting to the same belligerence that had so disturbed him about MacDonald at their first meeting. Reproaching himself, he immediately retreated to a more civilized tone, "And we can't put the carcass on display and still maintain secrecy until the entire procedure is successful. Maybe after that you can set up your display case."

MacDonald looked piqued. He was not used to having people resist his will. "I thought it was *our* mammoth, Lucien." His voice carried a reciprocating undercurrent of annoyance which he also quickly suppressed. "Well, no matter. Maybe we can discuss it again some other time."

They exchanged a few more civilities. Then MacDonald and his two aides left, leaving Lucien considerably perplexed. He shrugged and went back to his attempt to force a pathway through the thicket of his federal-aid report.

Lucien was listening impatiently to the preliminary research report. The chancellor had demanded the affirmative action report to be completed by tomorrow morning, so Lucien shouldn't have taken time off for this meeting.

Paul Randall, a Senior Research Biologist heading up the chromosomal consolidation team was saying, "The tissue is in remarkably good condition.

The freezing must have been very rapid. The cells close to the skin froze so quickly that 80% of them are unruptured. The musculature under the skin is about 72% unruptured. The . . ."

Lucien interrupted him impatiently, cutting to the essential element. "How coherent are the intestinal cell nuclei?"

Showing signs of annoyance at being interrupted by Lucien, Randall responded, "About 28% unruptured, but with some deterioration evident even in the unruptured cells." Randall dimmed the lights and flashed a slide on the wall. Lucien saw an array of sixteen cells arranged in four rows of four. His eyes flicked with satisfaction from one to the next and back, comparing them. Randall was still speaking. "As you can see, they all show slight deterioration. We think that by isolating each individual characteristic and comparing it with other cells, we can construct a composite cell model which is completely undeteriorated. Then . . ."

Again Lucien interrupted, this time without the impatient rudeness he had exhibited a few minutes earlier, and offered a caution. "At least a cell model without any gross chromosomal deterioration. At the molecular level we won't be able to do any more than guess and pray. But this all sounds very encouraging. Let's get on with the construction of the chromosomal model."

And with that he excused himself from the meeting and returned to his office to complete his reports. The University chancellor didn't give a damn about chromosomal models but he was making ominous noises about those reports.

Lucien was struggling with the monthly effluent discharge report when Doris called into the office, "There's a James Wilson on the phone, Doctor."

Lucien put down the pencil that he had been picking his teeth with while he tried to find the path leading out of the maze of figures in front of him and picked up the phone. "Yes, Jim. What can I do for you?"

"Oh, I've just got a small favor to ask of you. Nothing that will take up any of your time. Just something minor."

Lucien's guard came up. Anyone who started out like that must want a big favor. He waited for Wilson to make the request but Wilson said nothing—as if expecting Lucien to grant the small favor sight unseen—a pig in a poke.

Finally, after a pause that became embarrassingly long, Lucien asked, "What's the favor, Jim?"

"Ah, well, I need some pictures of the mammoth."

"Is that all? I thought you already had photographs. Harrison MacDonald said you had some beautiful pictures."

"Well, now he wants some more. We need to update our file."

Lucien didn't see how there could be any harm in that. "Sure. Send over

a photographer. Just tell him not to get in anybody's way."

"Ah . . . well . . ."

Lucien was getting annoyed. "Do you need something else, Jim?" His voice signaled his irritation.

There was a pause. Then, "No, I guess not. That's fine Doctor. Thanks."

Lucien returned to his maze.

The shrimp chow mein was delicious and the company was delightful. Lucien was having lunch with his daughter, Hazel—seeing her for the first time in months—and thoroughly enjoying the diversion from the morass of paperwork into which his job had sunk. Now, he sat silently cutting an eggroll with his fork and listening to Hazel enthuse about her job and her new apartment and her new car—a Porsche—and her newest boyfriend. She paused for breath, inhaled a deep drag from her cigarette, casually exhaled a cloud of smoke into Lucien's face, and then began to enthuse about how delicious the food was. Lucien coughed and set down his eggroll. Somehow the flavor wasn't there when it was blanketed by a thick cloud of noxious gases.

Hazel finally ran out of things to tell Lucien about and asked, "So what have you been doing with yourself? You've been making me do all the talking."

Lucien chuckled and Hazel grinned. The only interesting thing that came to Lucien's mind was his mammoth project so he told her about that and about the problem he'd had getting funding. As he described the mammoth, she had looked politely interested. As soon as he mentioned Harrison MacDonald however, her look of interest became one of shock, horror, and concern.

Ferociously, Hazel crushed her cigarette in the sauce left from her sweet and sour pork. She again exhaled into Lucien's face and exclaimed, "You've gotten involved with Harrison MacDonald!? That's terrible! You can't associate with a man like that! He's absolutely amoral. He's a social parasite!"

Lucien's jaw dropped in amazement at Hazel's utterly unexpected reaction. "What are you talking about!"

"We've been researching MacDonald and Tristar for a class-action lawsuit charging unfair economic practices, price fixing during the oil embargoes and environmental damage caused by his pipeline. And what we've learned is that he's dangerous and absolutely ruthless!"

Lucien was at a loss for words. He opened his mouth to make some feeble reply but instead of words an inadvertent laugh issued forth. The image of MacDonald recoiling in obvious discomfort from the cadavers in the refrigeration room had formed in his mind and contrasted itself with Hazel's description of MacDonald as dangerous, ruthless, amoral, and parasitic.

The unexpected laugh startled Hazel even more than it did Lucien. "What's so funny?" she demanded

angrily. "I'm serious! He's dangerous!"

Lucien told her. Then he recalled the time he had taken Hazel on a tour of the Medical center when she was thinking of medical school instead of law school. He had not wanted to take her into the storage room and she had practically had to beg him to let her go in. She had toughed it out much better than MacDonald had but Lucien suspected—although she had never been willing to admit it—that was what had set her mind on law rather than medicine. He laughed again and reminisced about that incident also. Soon Hazel was laughing too and the tension was forgotten, but not the subject matter.

"So all that shows is that he's got a queasy stomach, Papa, but I'm serious. He's power hungry. He takes whatever he wants anyway he can get it, and he destroys anything or anyone he can't control. He has no ethical principles at all. Please don't get involved with him!"

Hazel had verbalized some of Lucien's own semiformed fears about the relationship but he was reluctant to admit that he even partially shared them. Instead, he said, "Well, actually, Hazel, I think you're exaggerating a bit. I checked around and was told that he drove a hard bargain but had a reputation of integrity. He's very highly thought of in the community—a lot of philanthropic work and so forth."

"But whose money is he being philanthropic with?" Hazel exclaimed angrily. "Where did he get it and how?" Her eyes flamed scorn. "And who did you get character references from? The First National Bank and the Chamber of Commerce? You should have talked to some of his victims. I'm sure he's perfectly friendly and generous now, Papa, but as soon as you get in his way you'll find he's suddenly very pushy. He won't take no for an answer." Her voice trickled off into a tone of imploring. "Won't you please be careful?"

Lucien smiled wanly at her and reached across the table to pat her hand. "Don't worry, Hazel. I can take care of myself."

"That must be why you just dipped your sleeve in my sweet and sour sauce."

Lucien looked down at his sleeve, mumbled some profanity under his breath, and began to wipe off the sauce with his napkin.

It took Randall's chromosomal consolidation team three weeks to develop the composite cell model and select a group of donor cells. In the intestinal track where the most desirable donor cells were located, less than one tenth of one percent of the cells showed no evidence of disintegration. As Lucien sat examining diagrams of the idealized cellular layout, Randall said, "We were very conservative in establishing the criteria for a normal cell. I'm sure we rejected a lot of perfectly normal cells just to be on the safe side."

Lucien grinned. Things were beginning to shape up. "Then all we have to

worry about is disintegration at the molecular level. Have you tried to stimulate cell division yet?"

"No. That's the next step, but I wanted you to see what we had done so far." With that he left, leaving Lucien to wonder whether it hadn't become the staff's project instead of his own.

Lucien was trying to total a column of figures in the Controlled substance monthly report when an alarm went off indicating that the temperature in the refrigeration room had risen above freezing. That could be a disaster, destroying the mammoth and the rest of the freezer's contents.

As he came up to the door one of his graduate students came sailing out of the room and slammed against the opposite wall. Lucien didn't believe his eyes. What could be going on? He started into the room and came face to face with two burly men barring his entrance. He looked past them and saw that the room was full of huge floodlights and photographic equipment. There was a full scale movie production going on, and in the midst of the chaos, casually directing the film crew, stood Wilson.

Lucien tried to push into the room, squeezing between the guards, but they barred his way. "Wilson!" he yelled between the shoulders of the guards. "What the hell are you trying to do! Get those lights turned off before you ruin everything in the room!"

Wilson turned around calmly. "Oh, hi there, Doc. How are you today? We'll be done here in just a little while and then we can turn the lights off. Don't worry. We'll be careful of your . . . ah . . . frozen goods."

Lucien was turning blue in the face—not from the cold, but from anger. "Are you crazy? In a little while everything will be ruined! You've got to get those lights off now and get out of here! The temperature's already fifty degrees!"

"Yeah, but it's still awfully cold in here. Just relax. We only need twenty more minutes."

Lucien was speechless with anger. He tried to repeat his demand that they get out of the refrigeration room but only mumbles emerged. He suddenly lunged forward and squeezed past the two men blocking the doorway. Once inside, he ran to a wall socket and began unplugging the floodlights but the doormen were right behind him. They pulled him away from the socket while a third photographer plugged the lights back in.

Now Wilson reacted with anger. "Damnit! Now you've ruined that take and I'll have to do it over again. This'll take longer now. I've got to get these movies, Doc and you're not going to stop me. *I have got to have them!* MacDonald insisted that I get them. Now you just cooperate and I'll get out of here as soon as I can." The doormen physically removed Lucien from the room.

Lucien looked at the temperature gauge. It was already up another three degrees. He had to do something

immediately. Suddenly he grabbed the refrigeration compartment's door and swung it shut with a thud. He threw the bolt and sealed the photography crew inside. He then ran down the hall and around a corner to the custodial offices and directed the maintenance man to pull the fuses on the section of the building in which the refrigeration room was located. That would at least slow the heat buildup—and incidently leave the photographers in pitch darkness among the cadavers and the jungle of lamps and wires they had strung. Lucien felt a twinge of sweet revenge as that image appeared in his mind. But he still had the problem of the heat that had already built up. He ran back up the hall and glanced at the temperature—55 degrees.

He had another idea. He motioned for two of the students who were now milling around in the hall to come with him and they all ran out onto the loading dock where the dry ice was kept in a small chest freezer. The three of them lifted the canisters containing the dry ice out of the freezer and carried them down the corridor to the refrigeration room. Lucien told a fourth student to open the door quickly and to be prepared to swing it shut again fast. He nodded and the door swung open. The sudden light caught the men inside unprepared and Lucien and the students had flung the contents of the canisters all over the floor of the refrigeration room before the photographers could react. As the door was swinging shut again, they were just beginning to demand that he let them out.

"It'll only be a few more minutes. Just relax." Lucien shouted at them as the door thudded shut again. He glanced at the temperature gauge. It was showing an immediate reduction in the room temperature.

Lucien's whole body was shaking from the adrenaline coursing through his system. His ears were pounding; his chest was throbbing. "Wait until the temperature gets down to twenty-five degrees and then call the campus police. Tell them that I want these hoodlums arrested and charged with everything in the book, including assault!" Lucien took a blood pressure pill from his coat pocket and popped it into his mouth, bending over a drinking fountain to swallow it down. Then he walked carefully back to his office, exerting a mental effort to relax himself and to slow down his pounding heart. Once in his office he submerged himself in the bureaucratic paperwork, and for perhaps the first time, was grateful for the mindlessness it demanded. After twenty minutes of that regimen of enforced mental vacuousness his pulse had returned almost to normal. So long as he kept the memory of the day's events from creeping into his mind, he was able to keep his pulse under control, and even accomplished something on the reports.

Lucien was slipping on his overcoat—it was 23° outside—the coldest day since he had been in Houston—when the phone rang. He had been

expecting a call from the chancellor so he headed out the door with one arm still in its sleeve. He was just into the hall when Doris called out, "It's Harrison MacDonald."

That brought Lucien up short and the memory of the morning's events came spilling back. He hesitated between walking out on MacDonald and taking the call, but his resurging anger finally forced him back into the office. He picked up the receiver and said evenly, "Yes, Harrison. What can I do for you?"

"I'm not sure, Lucien." MacDonald's voice was equally even—as serene as the eye of a hurricane. "My legal people just posted bail for a crew of company photographers and for Jim Wilson. Wilson tells me an incredible story—that you gave him permission to photograph but when he set up you went into a rage and attacked his photographers and tried to destroy his equipment, then locked them into the refrigeration room without lights and finally had them arrested. Now obviously I don't believe that story, but I'm awfully curious to learn what really did happen."

Lucien did not answer immediately. Wilson's voice rang out in Lucien's mind declaring that *MacDonald insisted that I get them!* And on the heels of those words echoed the voice of his daughter warning Lucien to be careful—that MacDonald was dangerous and ruthless and devious. Lucien's latent anger was too strong for him to be in full control of his words and inflection. Rather than indirectly trying to draw out a damaging admission from MacDonald as he would under calmer circumstances, he asked bluntly, "Did you order Wilson to take movies of the mammoth?" The belligerence in his voice was sharp and must have put MacDonald on notice to be very careful with his reply. Lucien realized his error but could not call the tone back.

There was a calculating pause before MacDonald replied with caution in his voice, "Yes, I did. He mentioned that he was going over and I told him to get some movies. That didn't seem particularly unreasonable, Lucien." He stopped, leaving it for Lucien to advance the conversation.

The reply was too ambiguous to release Lucien's pent-up righteous indignation. He tried again. "Did you tell Wilson to clear his plans with me first?"

That question was a little too transparent and the surface calmness of MacDonald's voice broke as he replied, "Damnit, Lucien. Of course not. I don't tell him when to blow his nose either! I only told him to get the pictures. Working out the arrangement shouldn't have been impossible, even for Wilson. Now quit playing word games with me and tell me what happened!"

MacDonald's sharp tone released the anger and Lucien replied with intemperate forcefulness, relating the events of the morning to MacDonald. Having relieved himself, he paused, expecting that MacDonald would also reply with escalating anger.

"Well, that's quite a long way from the version that Wilson gave me. Was there serious damage?"

Lucien was taken aback. He still had some lingering cathartic need to vent his anger on MacDonald, but that comment left no opening. Mentally wrenching himself into a different posture, he answered, "I haven't had a chance to assess the damage yet, but there will certainly be surface damage to everything in the room, the cadavers as well as the mammoth."

"Well, don't worry about the damages, Lucien. I'll see that it gets taken care of, even if I have to take it out of Wilson's hide. I'll take care of it."

At that, Lucien's still unquenched anger reasserted itself. Despite MacDonald's conciliatory tone, Lucien exclaimed, "How are you going to take care of it! How are you going to replace thirty-thousand-year-old mammoth cells? Mount another search next year? And the cadavers! The medical students have put several years of work into some of them. They're just like old friends to the students! How can you replace that! The damage is irreparable!"

"Well, Lucien," said MacDonald soothingly, "I'm sure there will be something we can do to make up for the damage." He paused but Lucien said nothing. The adrenaline was flowing again and his heart was beginning to pound in his ears.

MacDonald picked up the dangling conversation. "About Wilson and the photographers. I'd like to ask you to drop the criminal charges. I'd rather take care of Wilson in my own way and the criminal charges seem a little extreme for the situation."

At that, Lucien's temper finally let go completely. "Like hell it's too extreme! They broke into my laboratory; they deliberately damaged priceless scientific materials; they physically assaulted a student and myself! How can you say that's not too extreme. There's no way I'll withdraw those charges!"

Another long pause in the conversation. "Well, Lucien. I'll look into remedying the damages and call you back tomorrow. You think about dropping the charges."

Before Lucien could make another angry retort, there was a click in his ear, and MacDonald was gone. Actually, the final burst of anger had calmed Lucien. He finally felt better, having gotten the anger completely off his chest. Better he should berate MacDonald than that he should take it home and kick the dog.

Lucien headed back out the door to go home and ran, almost literally, into Paul Randall coming into the office. "Yes, Paul?"

"I didn't realize you were leaving. This can wait until tomorrow."

"No, no. That's all right. What is it?"

"We've made an inspection of the refrigeration room. It looks like the damage is only minor. You stopped the thawing just barely in time. The room temperature climbed well into the fifties, but the surface tempera-

ture of the material in the room stayed in the very low thirties. The fact that the material was kept well below freezing normally left enough latent cold in the material to prevent any significant thawing before you got the air temperature back down below freezing."

That news was both good and unexpected. In the heat of the action and the anger, Lucien hadn't really thought through the probability and process of the damage. He thought again of MacDonald's request to drop the charges against those hoodlums. Even if they hadn't caused any serious damage, they could have, and with any further delay they would have. His anger was justified, he decided, and Wilson and his crew could stay in jail until they rotted.

Randall spoke again. "Being locked up in that little room in the pitch darkness surrounded by our cadavers really got to some of those photographers. They came out of there looking pretty glassy-eyed—like they'd seen a ghost."

Lucien laughed heartily at that image, although Randall's expression and tone didn't suggest he had intended it as an amusing anecdote.

Randall continued, "We had to let them out before the temperature got down as low as you wanted because several of them got hysterical and wouldn't stop screaming. They had to take one of them to the campus infirmary and put him under sedation. But they think he'll be all right."

Lucien's lingering chuckle trickled off into a nearly subvocal "Ohhh my . . ."

"This is fantastic, Paul!" Lucien was peering through a binocular microscope at a blastula stage cluster of cells. This was the first positive indication they had gotten that the project could succeed. The blastula had developed from an intestinal mammoth cell that had been placed in an extremely rich nutrient bath and then carefully pricked at with a microsurgical needle. The stimulation/irritation combination had caused the cell to begin dividing and the blastula in Lucien's field was the result.

"And even better news. Over three-quarters of our attempts to induce cell division were successful."

Lucien straightened up slowly. He felt himself being overcome by excitement. He consciously regulated his breathing and said with a forced calm, "That's excellent, Paul. Call Dr. Hamilton and find out how soon Phoebe will be ready for us."

Lucien returned to his office to review the biannual employee evaluation forms and to decide how to deal with one of the technicians that seemed to have a persistent Monday absenteeism problem.

Lucien was leaning back in his chair with his feet up on a small cleared corner of his desk resting his back and neck—they got stiff and sore from bending over these cursed reports hour after hour. He was staring absently at the articles about his previous

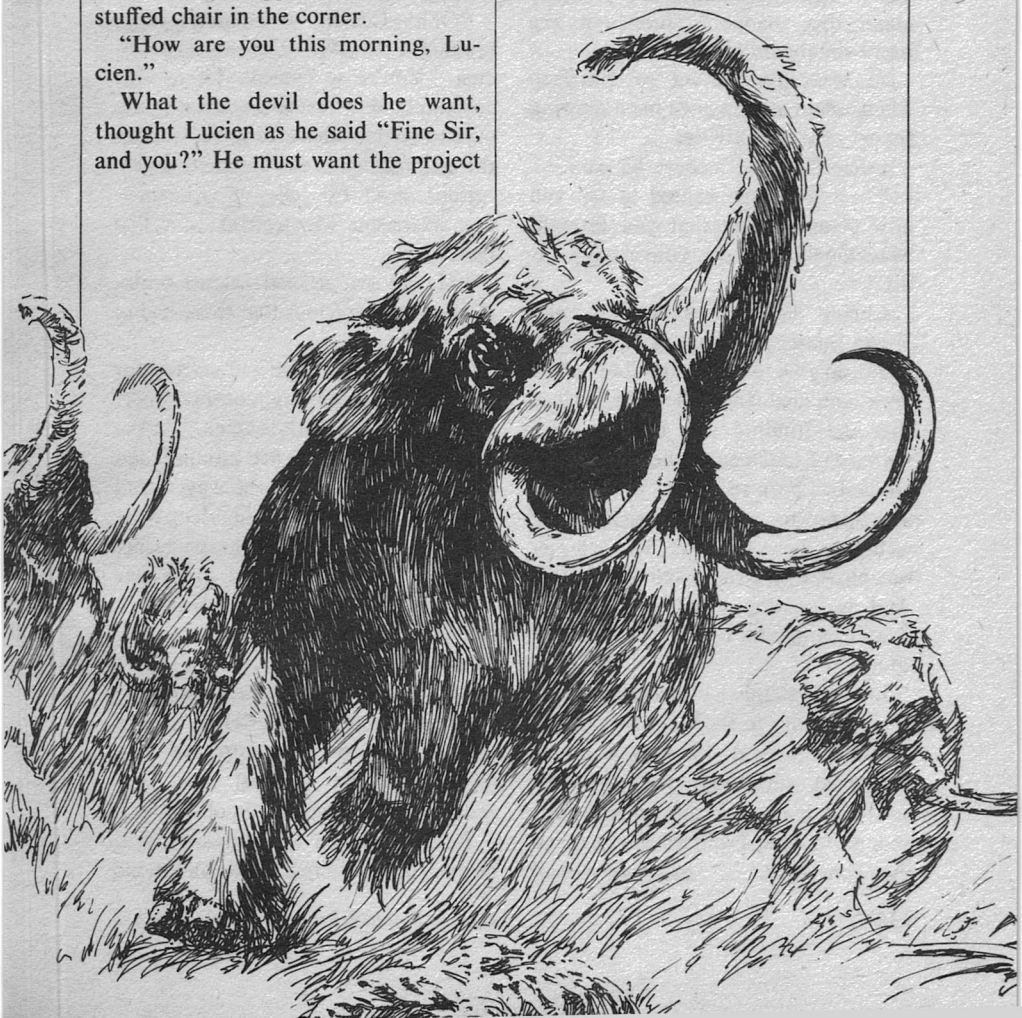
achievements and disappointments and thinking of the sensation that his current project would cause in the scientific community when Doris called out loudly, "Good morning Chancellor Baxter."

Lucien barely got his feet down off the desk before the chancellor was bouncing into the office—he always bounced wherever he went—and immediately dropped himself into the stuffed chair in the corner.

"How are you this morning, Lucien."

What the devil does he want, thought Lucien as he said "Fine Sir, and you?" He must want the project progress summary that was due last week. "I'm almost done with the reports for last month, and then I can get you the project summary. I should have it by the end of the week."

The chancellor laughed his deep hearty laugh, and said, "No. That's not why I came down here. I wanted to congratulate you on the progress you are making with your mammoth project."



Now that startled Lucien. When Lucien had tried to get University funding for the project, Baxter had been actively derisive, and when Lucien had tried to get funding from other traditional sources, he had suspected that Baxter was secretly undermining the applications so that the money would remain available for Baxter's pet projects. Lucien wondered what had happened to bring about this change in tune and was immediately enlightened.

"I was just talking to Harrison MacDonald and he gave me a glowing report of your activities . . ."

Lucien couldn't believe his ears.

". . . so I just wanted to tell you how pleased I am that you brought MacDonald into the University's orbit."

Lucien laughed right out loud. When Baxter had learned that Lucien had been able to secure funding he had been annoyed and when he learned that the funding was coming from Harrison MacDonald, the evil oil baron, he had been so furious that Lucien had feared for a few days that Baxter would void the contract. Now Baxter was pleased to be associated with him. And as for who was in who's orbit, Baxter might be in for a rude shock later.

Lucien's laugh had brought a look of uncertainty to Baxter's face, but he continued anyway. "Harrison was so impressed with your activities that he's decided . . ." he paused long enough to whet Lucien's interest, and then continued ". . . to endow a chair in genetics at the University!"

Lucien nearly fell out of his chair. That was a totally unexpected bonus. The field needed more people working in it.

"That *is* marvelous news," he exclaimed enthusiastically, but even as he said that his mind asked what had prompted that sudden and unexpected generosity. "What's the catch?" he asked Baxter.

"Ohhh, Lucien," responded Baxter, fanning a handful of air toward Lucien. "You're so cynical. There isn't any catch. Our business agent is going over to see him this afternoon to make the arrangements. It's completely gratuitous. And I'll tell you, Lucien—that Harrison MacDonald is a fine man."

"Maybe so," agreed Lucien tentatively, still suspicious that there had to be a catch.

Baxter rose to leave and started for the door. "You get my monthly report in on time this month, Lucien." At the door he paused, turned around and said casually, "Oh, by the way. I told Harrison that I would drop the charges against his photographers because I felt that we had made our point and that they had learned their lesson. Take care of it for me." And he turned to go out of the room.

Lucien's uneasy pleasure turned to comprehending anger. "Hey, wait a minute. I signed the complaint! You can't drop the charges! And that sounds like he bought you off!"

Baxter recoiled as though he had been struck. He drew himself up to his

full height—5′2″—and thrust out his chest. With mock restraint he emphatically declared, "You are mistaken, Lucien. He didn't ask me to drop the charges until after he had already committed himself to the endowment. There wasn't any deal. It just seemed like the fair thing to do. And how dare you question my integrity!" That last was intended to be angry but it came out merely as a high-pitched squeak. "Now, Lucien. If you think about it for a minute, I'm sure you'll want to drop those charges too!"

So Lucien did think about it for a minute. A chair in genetics for dropping the charges. That wasn't too bad a trade. "As soon as Alan comes back with the papers setting up the endowment," he offered somewhat tentatively.

"No Lucien. Now. This morning."

Lucien laughed. "That must have been part of the nondeal!"

A cloud of rage burst out melodramatically on Baxter's face. If the carrot doesn't work, thought Lucien, try the stick. So, rather than push Baxter any further, Lucien acquiesced.

"Well, if you feel that's best, I guess I'll go along." He paused, and Baxter, unsatisfied with Lucien's capitulation, started to open his mouth. "And I'll take care of it this morning," Lucien added. Baxter closed his mouth, put his melodramatic rage mask back into his pocket, and replaced it with a genuine plastic smile. As he went bouncing out of the office Lucien leaned back in his chair, put his feet back up on the cleared patch of desk and marveled at the things that money could buy.

The smell assaulted Lucien's nostrils with an overwhelming malodorousness. He wrinkled up his nose and coughed but that didn't help. He glanced up at the barred windows. They were already open. His only avenue of relief seemed to be to leave the room and he wasn't about to do that. He forced a grin onto his face, shook hands with Dr. Hamilton, and turned to look at Phoebe, lying unconscious on the floor.

After several minutes of further preparation, Dr. Hamilton switched on a large suction device. After several more minutes the machine switched off and the veterinarian handed Lucien a small canister containing the contents of Phoebe's uterus and fallopian tubes, saying, "I hope we've got what you need in there."

Lucien accepted the canister with a very brief thank you and fled the effluvial vapors of the elephant house as Dr. Hamilton turned to his assistants and said, "Let's cut her toenails while she's asleep."

Lucien was reviewing the preliminary draft of the second quarter expenditure projection when his intercom buzzed and his secretary announced, "Paul Randall just called and said they've located the elephant egg. He's holding it on the microscope in case you want to come down before they begin the transfer procedure."

"Tell him I'm on my way, Doris."

He jumped up from his desk leaving the oppressive reports for later and rushed to the lab. He had feared that they would be unable to locate the egg. That would have meant yet another interminable delay.

One of Lucien's graduate students skilled in the use of the microsurgical apparatus had been selected to perform the exacting and dexterous tasks required at this stage of the project. While the student stood by, Lucien leaned over and peered through the binocular eyepieces at the egg floating in the field. The project had been a part of him for so long—had seemed so unattainable for so long—and was now so near to the decisive moment—that he was gripped by a boiling excitement. The frustration of his long absence from the laboratories and of his entrapment by the bureaucratic morass welled up and became entwined with his excitement. Frustration and excitement, hand in hand, momentarily obscured his intention to have his sure-handed graduate student perform the actual work. Lucien picked up one of the microsurgical tools and reached toward the microscope to remove the egg and set it aside. As he did so, his hand passed unsteadily before his eyes. One of the lab assistants coughed discreetly and Lucien realized how badly his hand was shaking. He put the tool back, turned to the graduate student with an embarrassed and embarrassing grin and excused himself. "I guess I'm too excited. You'd better take over, Janet."

Janet placed the egg in a culture dish and set it aside; then placed some of the mammoth cells which exhibited no apparent chromosomal deterioration into the apparatus. She began to tease away the surface of the cell. Lucien waited in tense silence while she did so, pacing about the room like an expectant father.

Finally she stepped back from the apparatus and motioned for Lucien to examine the results. He did so and then exclaimed, "Excellent, Janet!" She had achieved a clean separation of the nucleus from the remainder of the cellular material. "Now see what you can do with the elephant ovum."

The unfertilized nucleus of the ovum had to be removed without collapsing the cell wall. No portion of the original chemical package could be allowed to pull off and remain in the cell.

Janet operated slowly and carefully. After a seemingly interminable wait, she stopped manipulating the equipment and peered intently at the cell. "There's still a particle of nucleic material in it."

Lucien's stomach cramped hard, bringing a grimace to his face. He peered through the eyepieces. The particle seemed near the surface. "Try to remove it."

The girl slowly teased at the particle. "I've got it," she finally announced.

Lucien's relief surfaced as a grin. He again examined the cell. The nucleic material appeared to have been fully removed. The stability of the cell

wall appeared adequate despite the rupture. "It looks good," he said, stepping aside again. "See if you can insert the mammoth nucleus."

Janet took up the tool holding the ancient nucleus. There was total silence in the room while she made the insertion and carefully examined the completed transplant for evidence that any of the nuclear material had become separated from the rest of the nucleus. "I think it's okay," she announced at last.

Lucien peered into the microscope, his again trembling hands belying his attempt to appear calm, and also concluded that the transplant was an apparent success. "Great work, Janet! Now see if you can close the cell wall at all."

Working meticulously, she reshaped the protoplasm of the cell and then carefully placed it on a thin glass disc and immersed the disc in a high nutrient solution. The solution was placed in an incubation chamber and the procedure was complete.

"You did a fantastic job, Janet," Lucien said, and patted the girl on the shoulder. She grinned and winked at him.

Lucien turned to Paul Randall. "Keep a close eye on our progeny, Paul, and let me know as soon as it shows any signs of beginning to divide."

Lucien left the lab and returned to his preliminary expenditure reports. He had to coax the right answer out of his numbers or he would end up with a hiring freeze slapped on him. Within minutes the satisfied afterglow of the laboratory had been extinguished.

Lucien was in the kitchen heating himself some milk and dissolving some brown sugar into it for his breakfast cup of coffee. His fondness for coffee fixed with hot milk and brown sugar was one of the few lingering traces of his Britishness. Nancy would have nothing to do with it. She was sitting at the dining room table with a bowl of cereal and reading the Post. "There's a picture here of Harrison MacDonald. Isn't he the man who's financing your project?"

Lucien put down his stirring spoon and went into the dining room. "What's he done to make the papers—get a speeding ticket?" Lucien leaned over his wife's shoulder and saw a picture of MacDonald handing a check for $350,000 to the president of the Houston Symphony for their construction fund. "It says he's chairman of this year's fund-raising committee and that they conducted the most successful drive in the symphony's history, but that it is suspected that he personally matched the total collected from all other sources."

Lucien laughed at that. "He'd better watch out or he'll be in demand to chair every fund-raising drive in the state. He just endowed a chair at the University, too."

Lucien heard a boiling sound coming from the kitchen. "Oh, damn. My milk's boiling," and he hurried back into the kitchen to stir and turn off the heat.

"Hazel came by to see me yesterday," his wife said to him through the door. "We had a pleasant visit."

Lucien laughed without humor. "A pleasant visit with your own daughter. That's a switch. I'm glad she's mellowing a little."

Nancy didn't seem to appreciate Lucien's laughter. "She was talking about Harrison MacDonald, too."

"She doesn't seem to like him very well."

"Well, he can't be as bad as she seems to think if he gives that kind of money to the symphony!"

Lucien laughed again. "He probably wanted to get his picture in the paper. That kind of money is just pocket change to him."

He took the coffee off the stove and brought it into the dining room. As he did every morning, he offered some to Nancy who, as she did every morning, made a face at him. It was all part of their regular morning ritual.

Nancy continued the conversation. "Maybe it's only pocket change but at least he put it into something useful."

Nancy put down her paper and looked Lucien squarely in the face. "Hazel was very emphatic that MacDonald was a dangerous man to be dealing with. She was very concerned that you would get hurt before this was over. Are you sure you know what you're doing? I hope you'll be careful."

Her serious tone caused Lucien to drop the frivolity and respond with an equal seriousness. "Don't worry about it Nancy. How can he be dangerous to me? There's nothing he could do, even if he wanted to. It's a scientific experiment. It doesn't have any bearing on his business activities except in his advertising, and while that's been awfully annoying, it hasn't been in the least bit dangerous. I've been thinking about it since Hazel talked to me and I can't see anything that he could possibly do." Unless there were problems lurking in that damned obscure contract, he added to himself, but even if there were, they could only be minor annoyances also. He continued his reassurance, saying, "Hazel's just wearing her politics on her sleeve again. She doesn't like MacDonald's company and she's generalizing from that. So don't worry. Nothing's going to happen."

"Well—you just be careful. I know Hazel gets some funny ideas sometimes, but she's really worried about you."

"I know it. I'll remember what she said, but I can't see any problem." There was nothing more Lucien could say and the conversation trailed off.

Lucien finished his coffee and toast, kissed Nancy on the forehead, and left for the office. He had to complete the monthly research schedule for the chancellor by the end of the day and after that, he had to get back to his expenditure projections. It looked like another day when Lucien wouldn't be able to get into the labs to work on the project.

Lucien was still ensnared in the

expenditure reports, now trying to juggle his payment vouchers so that he didn't exceed his monthly expenditure ceiling, when Janet came bounding into his office. "We've got our first division! It's going to work!"

Lucien jumped up from his desk and rushed down to the lab. When he stepped through the door, a dozen people burst into excited applause and congratulations. Lucien was immensely pleased. His chest swelled and he thanked everyone expansively for their compliments. He then motioned for silence and returned the compliments, assuring them that it was their efforts that had made the project a success. And as he spoke those words, he felt a twinge of bitterness, for they were all too true. He had contributed little more than the basic idea.

He stepped forward and looked through the microscope at the now-dividing cell. It was a beautiful sight, but hardly conclusive evidence that success was now assured. He turned to his colleagues and cautioned, "It's still much too premature to congratulate ourselves. We had better save the real celebration for another twenty months or so and see how our little mammoth comes out."

The now-dividing zygote was returned to Dr. Hamilton. Phoebe had already been anesthetized for the second time when Lucien arrived. In the excitement of this second visit, Lucien didn't notice the noxious odors. The zygote was carefully inserted into Phoebe's uterus. "If this is successful, Phoebe," Hamilton said with a grin and a wink to Lucien, "you're going to get quite a remarkable surprise."

Lucien was struggling to balance a column of figures in the quarterly federal-aid research assistance report when his secretary announced that Tom Stockton was outside and would like to see him. Ever since the incident with Wilson, it had been Stockton who kept dropping by—to keep an eye on the project for Harrison MacDonald, Lucien suspected, though Stockton always appeared under some other pretense. And Lucien didn't really mind. At least Stockton seemed to have a considerable intelligence and interest in the work that they were trying to do at the center. In fact, Lucien rather welcomed the visits as a respite from the paperwork that was devouring him.

Lucien rose and greeted Stockton with a handshake. "And what brings you out here today?"

"Some college group—the Women's Public Action Coalition?—invited Tristar to participate in a seminar on Business and the Environment, and I got nominated to do it. I'm going to tell them all about the virtues of the Tristar Environmental Plan. And since I was here I thought I'd stop by early and see if I could take you to lunch."

Lucien grinned. He passed over the invitation to lunch for a second to take a jab at the first part of Stockton's comment. "The program has virtues, does it? I had gotten the impression

from Wilson that it was all a figment of the PR staff's imagination!"

Stockton laughed lightly—a slightly strained laugh—and changed the subject. "How's lunch sound?"

"That sounds great. I'll be done here in just a second."

While Lucien was straightening out his papers, Stockton asked, "And how's our little monster coming?"

Lucien grinned broadly. "Everything seems normal. We've gotten positive results from the tests we've done on the fetal cells floating in the amniotic fluid. But of course we won't really know for sure until the baby is born." Lucien began to shuffle papers around on his desk. "I've got the latest report right here somewhere."

His paper shuffling took on a steadily increasing appearance of annoyance as he failed to find those few significant sheets among the reams of bureaucratic trivia. As he ruffled with undue vigor through a stack of files at one end of his desk, a book slipped off the top and fell against a precariously balanced pile of folders. That pile, full of backup material for his federal reports, slipped off the corner and fanned out across the floor.

For several seconds Lucien said nothing—simply stared at the disruption. Then he sat down weakly and said, "There are times, Tom, when I'd quit this job in a minute if I could get back into some real research. All I'm doing is filling out assinine reports for assinine bureaucrats. I can't even keep up with what my staff is doing, let alone do any research of my own!"

Stockton shook his head sympathetically and bent down to carefully slip papers back into the folders from which they appeared to have slithered. But Lucien stood up again and said, "Leave that garbage there, Tom. Let's go to lunch!"

As he left the office, Lucien called over his shoulder, "Would you please straighten out the papers in my office a little, Doris?" And he quickly ducked around the corner.

Pizza. Half cheese and pepperoni; half everything in the house from anchovies to peppers and onions. The aromas swirled about in discordant harmony while Lucien and Stockton engaged in animated discussion.

"I've been doing a lot of reading in genetics since we got involved in this project, Lucien. I can hardly believe the fantastic potential for the field. It all seems too good to be true."

"It is too good to be true. If we are careful, we could create a virtual utopia, but there are great dangers lurking behind the golden facade. Genetics will have as much impact on our lives as the automobile or television did, and they've certainly been mixed blessings. We can end starvation or we can simply accelerate our decadence. We have to realize what we're doing and decide where we want to go soon. Once the techniques are developed and disseminated it will be too late!"

Stockton failed to pick up that line of conversation. He had been dazzled by the glamour and the superficial potentials rather than the conse-

quences of those potentials. Lucien shrugged mentally. There would be plenty of opportunity to discuss the flies in the ointment some other time. The conversation drifted along until Stockton had to leave for his seminar.

As they shook hands and parted, Stockton said, "Harrison has been very impressed with all this. Things should start moving around here before long." In the commotion of getting their coats and paying for the pizza, Lucien didn't get an opportunity to ask what Stockton meant by that. Perhaps when he got back to the office he'd write himself a note reminding himself to call Stockton and try to find out.

But when he got back to the office he found himself facing Doris's scorn and revenge. As he walked into the anteroom she flashed him such a big cheerful smile that he instantly knew something was amiss. He entered his office with considerable trepidation and found that it was immaculate. He couldn't even find his favorite pipe. He completely forgot the call to Stockton in the desperate search and ensuing relief when he finally discovered it in the bottom drawer and his tobacco on a shelf behind him.

Thinking he probably deserved that, he resumed work on the chancellor's quarterly report, and thought no more about Stockton's remark.

Six AM. An enraged mosquito landed in Lucien's ear. He swatted at it and the clamoring alarm was silenced. He rolled out of bed, staggered to the front door on stiff knees, pulled the morning paper out of the mail slot, and settled down in his creaking armchair to wake up gradually. He opened the paper and was instantly awake. There, on the front page, staring at him, was himself. **Local Scientist Creates Mastodon** proclaimed the banner headline. Lucien felt a flashing anger. Tristar had agreed to hold the publicity until the project was completed. They must have broken that agreement. And the headline wasn't even right. He hadn't created anything—especially not a mastodon!

With building anger, he read the article accompanying the headline. The cell nucleus from the mammoth's intestine contained the same genetic code as had the fertilized egg from which the donor mammoth had grown tens of thousands of years ago. But substituting that nucleus for the one in Phoebe's unfertilized egg and inducing it to begin dividing, the same result was achieved as if the egg had been fertilized normally. The dividing cell had been implanted into Phoebe's uterus and she had responded as though she had become pregnant through the normal course of events. Considering the source, the article was remarkably accurate. It concluded with a quote attributed to Lucien which praised Tristar for its foresight in backing the scientific research.

The doorbell chimed. Lucien looked at the cuckoo clock on the wall—6:20! He got up and glanced out the window. A station wagon boldly proclaiming station KDUM was parked outside

and two men were setting up photographic equipment. The doorbell chimed again. Lucien went to the door, slipped the chain lock into place and opened it slightly.

"Good morning Doctor Nighswander!" cheerfully bubbled a girl that Lucien recognized from the evening news. "We're absolutely delighted by your brilliant achievement. We'd like to ask you a few questions. If you'll just step out in front of our cameras . . ." and she tried to swing the door open. It hit the chain, startling her.

"Not now!" growled Lucien angrily, "and if you wake up my wife, I'll have you arrested for disturbing the peace!" With that he shoved the door shut in her face so violently that he woke his wife.

Lucien's anger was building. The clock chimed 6:30. He grabbed the phone and called Wilson.

After a dozen rings, there was a groaning "Hhulllo."

"Wilson, this is Lucien Nighswander. Why did you release the publicity on the mammoth project?" he demanded with anger in his voice.

Wilson was only slowly coming awake. "Mammoth . . .? Oh yeah. Hey! How'd you like it, Doc? It was a great article wasn't it? Harrison really loved it. I think we'll make a big splash with it."

"That's not what I want to know. We had an agreement not to release the story until after we succeeded. You broke it!"

"Now just a second, Doc," Wilson responded, fully awake now. "There's nothing about publicity in the contract. You really should have read it before you signed it!"

"We had an oral agreement not to publicize the story and you know it. Damnit! You broke our agreement!"

"Don't you accuse me of breaking any damn agreement. It's not in the contract and you signed it! Go stick your head in a bucket of dry ice!" and with that, a loud click sounded in Lucien's ear.

Lucien stared at the phone in disbelieving silence—then shrugged and hung up. There was no point arguing with Wilson. He was just a lackey, but he had confirmed the obvious. Tristar had released the story and MacDonald was responsible.

By then Nancy had come into the living room, seen the headline and the gathering crowd of reporters outside the house, and deduced what was wrong. She calmed Lucien down, gave him a cup of coffee—her style—and sent him outside to face the reporters.

As he stepped from the house, he recognized several reporters from the national news organizations. This, he thought, must have made quite a splash to bring them here.

His still smoldering anger and the premature publicity left Lucien directing his hostility toward the clustering reporters. He wasn't in a mood to be cooperative. He described the experiment in uncompromisingly technical terms that left most of the reporters milling about in confusion. Repeatedly he warned that there was

no guarantee of success. Some defect in the implanted nucleus might still cause the mammoth to be nonviable. As the questioning went on he repeatedly returned to the theme that success was not guaranteed but he had the impression that none of the reporters was hearing that caution. Finally, spurred on by the latent anger at Tristar and the fifth question about how soon the reporters could see the baby, he declared, "Ladies and gentlemen. The chances of success are no better than one in ten!" That caught their attention. It would make a good headline for the afternoon news.

When Harrison MacDonald read that headline, Lucien in his turn, received an angry phone call. "What's this nonsense about a one in ten chance of success! You told me there was a high chance of success!"

Lucien's anger of the morning was still smoldering, but was being gradually superseded by a recognition that he should have expected something like that from the type of people that he was dealing with. His voice tightly controlled, he replied, "What I told you was that this has a good probability of success, and as genetic experiments go, it does have. Besides, the guarantee of success was in the same addendum as the agreement on prebirth publicity."

"There wasn't any . . . hummmph . . ." and MacDonald's belligerent anger suddenly became a burst of bellowing laughter. "I suppose I deserved that. But if the chance of success is really as low as the newspapers say, I'll know I was right to jump the gun on the coverage and get all the publicity I can before the bubble bursts." The jab was returned, and oddly, it seemed to prick and partially deflate Lucien's anger.

"Well, maybe, Harrison, but you should have cleared it with me first."

There was a considerable pause on the other end of the line. Then MacDonald's voice came back with what sounded like a barely audible chuckle. "Well, actually, Lucien, I did clear that story personally—with Chancellor Baxter. He's a very easy person to deal with! And he just loved it!" The subvocal chuckle surfaced as a scornful punctuation. "So perhaps your anger is at least partially misdirected."

Lucien's anger flared again, but before he could do anything more than sputter, MacDonald was speaking again.

"I genuinely apologize for not talking to you, but I honestly can see nothing but mutual benefit for both of us in this timing."

On the strength of the apology, Lucien's anger subsided slightly, and he responded calmly, "Look, Harrison. Laymen don't understand the complexities of these processes. If they read about it in the paper, they're going to expect results—instant results. If the experiment fails, they'll feel cheated and even if it's successful, by the time it is, they'll have lost interest. It'll be old news. I don't see how it serves either of our interests!" Lucien's tone which had begun with a

hint of anger still lingering, had gradually transformed itself into annoyance and had trickled off at the end into disappointment at another lost opportunity to make a real splash.

"You leave the publicity calculations to us, Lucien. I've hired a lot of expensive PR men. They can better tell the impact than either of us. If it fails, we get a raft of good publicity now; if it succeeds we'll play it to get another big burst of publicity then. And they're experts at dragging out the interest. We can keep this thing going for the next six months."

Lucien tried to cut in with an objection, but MacDonald bulled his way past Lucien's attempt. He was leading up to something and wasn't about to be interrupted.

"Now you listen to me. By the time Phoebe gives birth, my people will have made your name a household word all over the world, and you'll be a sure bet for a Nobel Prize to hang next to your two near misses!"

As MacDonald finished, Lucien began to again assert his disagreement, but as MacDonald's words penetrated into his consciousness, his voice trickled off into an inaudible murmur. MacDonald had strummed exactly the right chord to soothe the savage beast in Lucien's brain. But how had MacDonald known that? Was his obsession that obvious? The pause while MacDonald waited for a response grew long. Lucien opened his mouth to make a retort but could think of nothing to say.

MacDonald, his tone suddenly light and cheerful, got Lucien off the hook by changing the subject. "Now Lucien, what about those long odds that the newspapers are having such a field day with?"

"Oh . . . well . . . ah . . ." Lucien was having a struggle directing his mind back to the moment at hand. "Well, actually, Harrison, I think the odds are more like fifty-fifty or even a little better. The only real question left is whether Phoebe can carry the baby to full term. We know the brain is active and the baby seems to be moving normally."

MacDonald ended the conversation, leaving Lucien still in a daze. He leaned back and put his feet up on the desk—right on top of the chancellor's quarterly report—and he didn't even notice. He was wondering whether MacDonald was really right about that prize.

Lucien was guiding a group of North Korean exchange professors on a frustrating tour of his facilities. They were such distinguished guests that they were being accompanied by State Department representatives, and even by the University chancellor. It was the first time that Lucien could remember the chancellor being in the labs since his get-acquainted tour five years ago.

Lucien's frustration resulted from the North Korean interpreter's difficulty with the scientific terminology. Lucien had been reduced to describing the facilities in the language he might have used for a local group of third

graders. And his mood was not lifted by the fact that, as he guided the visitors through the labs, he repeatedly discovered aspects of the various ongoing research projects that had progressed further than he had realized. He had become so entangled in paperwork that the tour was almost as much a revelation for him as for the visitors.

One of the research biologists came up and whispered, "Dr. Hamilton just called. Phoebe's in labor."

Lucien's gloom lifted instantly. "I'm sorry gentlemen. Something has come up!" He turned and headed out the door at a virtual run. "I'll have to excuse myself."

The State Department man looked shocked. Chancellor Baxter looked livid. "Just a minute, Lucien! You can't run out on our honored guests just like that!"

Lucien wasn't going to miss Phoebe's delivery for anything and a perverse desire to extract some small revenge for the mounds of debilitating paperwork made him unwilling to reveal the purpose of his departure. Without pausing in his flight, he snapped a flippant reply back over his shoulder. "I've got to go. We're having a baby!"

The chancellor's jaw dropped open, uncomprehending. The State Department man looked incredulous. The interpreter translated Lucien's parting words into Korean and the visiting delegation burst into amazed and delighted applause while the interpreter called out their congratulations to Lucien's fast receding back.

As Lucien rushed across the parking lot to his car, he laughed aloud in delight. Who else could claim to be the father? Perhaps his graduate student, Janet? She had done the actual impregnating! He laughed again. He'd have to discuss that with her some time in his scientific ethics seminar. As he drove toward the zoo, his excitement gradually metamorphosed into the classic nervousness of the expectant father. What if something had gone wrong!

But nothing went wrong. The baby was born healthy and strong. Within hours it was standing by itself, already covered with a short coat of shaggy red hair, seeming confused by the excited activity around it. If Phoebe noticed anything strange about her offspring, she gave no indication of it.

Lucien chafed to get close enough to examine the calf carefully but the excitement which was confusing the calf was enraging Phoebe. She backed the calf into a corner of the elephant house, interposed her immense hulk between the calf and the frustrated observers and screamed in rage to drive them off. That failing, she resorted to her surest method of ridding herself of pestilent caretakings and visitors—a method tested and true. With her trunk she scooped up a clump of excrement and flung it at the observers, squarely hitting one of Wilson's photographers. The observers beat a hasty retreat. Triumphant,

Phoebe resumed the care of her precious charge.

Harrison MacDonald had appeared as soon as he received word of Phoebe's triumph, bringing his two granddaughters with him. He was acting as excited as Lucien. When he was finally able to stop laughing at the indignity inflicted on Wilson's man, he turned to Lucien with effusive congratulations. So ebullient was his mood that even Wilson got a sound slap on the back and a word of praise.

"We've chosen a name for him, Lucien."

Lucien tensed at that. One of the minor annoyances in the contract was that it had given Tristar the right to name the calf. Now he stood, visibly tense, waiting for the pronouncement—fully expecting that some grotesquerie was about to be inflicted on his baby.

Into the tenseness stepped Tom Stockton. "I think he expects you to name it Tristar or Harrison, or something gross like that."

MacDonald burst into one of his bellowing laughs, not so unlike the sound Phoebe had been making short minutes ago, echoed a split second later by a squeaky laugh from Wilson. Stockton merely stood looking glib.

"Quite the contrary," responded Lucien. "In fact, were the choice mine, I might well name him Harrison myself!"

Again, MacDonald responded with an ebullient laugh and again Wilson played the echo.

"Seriously now, Lucien. If it is agreeable with you, I suggest we name him Renewal. I think that captures the essence of the entire project."

Lucien was astounded. He had been sure that this coarse and crass oil baron would concoct some horrible misnomer. With enthusiasm, he assented. "It's perfect!"

There was a great deal more excited talk. Then MacDonald said, "Tom has been telling me wild tales about all the possibilities your genetic research is opening up. I must admit that I've been skeptical but when I see that furry little beast lurking back there I begin to wonder if maybe there really are some great opportunities here!"

Lucien was feeling as ebullient as MacDonald. Incautiously and with uncharacteristic expansiveness he exclaimed, "We're on the verge of breakthroughs that will remake the entire world—end starvation, end human want, end menial labor, end congenital disease, end cancer, even vastly lengthen the lifespan of all humanity!"

MacDonald had turned sober and serious. "That's what Tom has been trying to tell me. It seems hard to believe, Lucien. I want to sit down with you some time soon and have a long talk about what all this really means."

With that, he gathered his two grandchildren together and departed, leaving Lucien shaking his head in perplexity, his sense of pleasure at the success of his project suddenly tempered by a clear sense of looming crisis. What had MacDonald meant by

that provocative parting remark?

Renewal was now strong enough to be presented to the public. There was a carnival atmosphere outside the elephant house—sun shining, children running and laughing, balloons blowing gaily in the breeze.

All the major news agencies were present—both national and international. Tristar had even flown the Swedish government news agency's Washington correspondent into Houston for the occasion at Tristar's expense. MacDonald had certainly made good on his promise to stir up some enthusiasm. Lucien surveyed the scene. It was more like a circus than a zoo.

Phoebe, and then her hairy progeny emerged into the sunlight. A rousing cheer went up but the noise scared Renewal and he retreated back into the safety of the elephant house. No amount of coaxing could persuade him to come out again, and finally the presentation was continued without him. Dr. Hamilton, representing the Zoo, made the initial presentation, followed by a speech from Lucien, but the keynote address was reserved for Harrison MacDonald and he made the most of it.

"Ladies and gentlemen! We have today entered a new era of scientific achievement for the benefit of mankind. The biological sciences have crossed the theshold. They have come of age. They have demonstrated their paramount importance to all of us."

Lucien grinned broadly. Those sentiments were music to his ears.

MacDonald continued. "The woolly mammoth has often been used as a symbol of the fate that lies ahead for mankind if he continues to abuse his technology and his environment. But the mammoth must now take on a new symbolism—it has become a symbol of hope for the future. The miracle of biological science has restored an extinct species to the world, and can prevent mankind from taking the same path to extinction. Today we have renewed more than an extinct species; we have renewed mankind's hope for his future. Today we have recreated this delightful and captivating species; tomorrow we will create entirely new ones for the benefit of mankind. To the public we say, 'Do not fear technology! Put your faith in it!' It will save us all."

It was the evening of Renewal's coming out party. Harrison MacDonald was entertaining Lucien and his wife, Nancy, in a private dining room at one of the most expensive and exclusive restaurants in Houston.

The waiter had just brought the wine—a wine of legendary richness. MacDonald was speaking enthusiastically as Lucien sat savoring the wine's exquisitely delicate nuances. In the face of such a wine, MacDonald's voice seemed far distant and almost blasphemous as he said, "I'm absolutely delighted with the results of this project. Renewal is absolutely captivating. He's opened my eyes to the fantastic potential of your work." He

paused, forcing direct eye contact by the delay, and then said with decisiveness, "I'm starting a genetic research and development corporation and I want you to direct it for me!"

That drew Lucien's attention away from the wine with finality. He set his goblet down very slowly and carefully. He betrayed no external reaction, but internally, his stomach and his mind had knotted up as tightly as the gordian knot.

MacDonald continued. "And to show you I'm serious about wanting you to run it for me, I'll give you a blank check for a budget and complete control over the hiring and research—and you can name your own salary!"

Nancy's eyes glowed in amazement and delight. Lucien felt no such delight. In his mind Hazel was screaming words of warning: *Don't get involved with him! He's dangerous and he's ruthless.*

MacDonald was continuing, now explaining the benefit to Tristar. "We can get a patent on Renewal!" He laughed a loud friendly laugh. "They patent orchids and white marigolds and tulips and seedless grapes! Why not a woolly mammoth?" His enthusiasm was building. "We can breed them for beef in the north country. We'll sell them to the ranchers conditionally with an extra six cents royalty on every pound they sell. We can become the Xerox of the food industry!" His eyes were glowing with the intensity of his vision.

Lucien was appalled. In one breath MacDonald was describing Renewal as absolutely captivating and in the next breath he was selling him off for beef at six cents a pound. A shudder ran up his spine.

A waiter entered the room and placed their shrimp cocktails—with eight of the largest shrimp that Lucien had ever seen—in front of them. Lucien ate without tasting and thought of the manipulations in oil prices during the last few years. He shuddered again.

MacDonald's enthusiasm burned on. "We can genetically change chimpanzees and gorillas to make them a little more intelligent and a lot more docile and then sell them for farm workers and manual laborers and domestics! We can liberate mankind from menial labor!" For the first time, MacDonald seemed to notice that Lucien's enthusiasm didn't correspond to his own. "You told me that yourself," he concluded on a weaker note.

"Well, frankly, Harrison, it's going to be a few years before we approach that stage," Lucien said slowly. "And there are all kinds of ethical considerations."

Again Hazel was shouting a warning. *He's absolutely amoral. He has no ethical principles at all. Don't get involved.*

"Have you considered the social impact of using gorilla laborers? That's awfully close to a morally disguised form of slavery. It could bring all the social evils that slavery produced. Not to mention the short range unemployment! Your new world might not be quite the utopia you expect."

"You certainly made it sound like utopia when we talked about it a few weeks ago, Lucien."

"Oh, all those things are possible, Harrison, but there are all kinds of disastrous potentials that are equally possible. If this technology is developed and applied promiscuously, it could destroy the ethical basis of our civilization. I don't want to buy material utopia at the expense of totally corrupting our moral system." He paused, then added, "I'm afraid I need some time to think this over."

"Yes, of course you do," MacDonald agreed amiably while ignoring the content of Lucien's objections. "But I want you to appreciate that you're the man I want. I need a man of proven ability and integrity." He paused briefly while the compliment took effect and then added, "I'll include in my offer five percent of the stock in the research corporation." He paused again while Lucien absorbed that—then continued, "And you can hire all the administrative staff you want to handle the paperwork. You told Tom Stockton that you'd quit in a minute if you could get back into the research labs. Well, here's your chance to jump back in with both feet!"

MacDonald's last piece of bait had struck exactly at Lucien's Achilles' heel. But with considerable effort he forced himself to repeat, "I need some time to think about it, Harrison."

Hazel was now screaming in his mind's ear. *He's pushy. He won't take no for an answer. Don't get involved.*

MacDonald was speaking. "Of course I won't try to push you Lucien, but I want you to realize how serious I am. This is the same offer I had to make to get Allen Singer to come down here and coach my football team! And he dickered with me for months before I was willing to throw in stock."

Lucien was somewhat annoyed at being put into the same category as some football coach. With slight annoyance creeping into his voice for the first time, he responded, "I've got to have time to think about it. I want you to realize how serious I am about how dangerous this could be. It could bring disaster as easily as utopia. I'm not sure we should go into full development of these things—at least not for a long while yet!"

For the first time, MacDonald laughed—and it was a scornful laugh. "That's ridiculous, Lucien. You can't stop progress! What did you expect to happen? And what were you planning to do? Go hide behind the pile of reports on your desk and fondle your Nobel Prize?"

Lucien flinched and leaned back away from the table and from MacDonald. He had no ready retort. He really hadn't thought beyond his hope for the prize. He stared angrily and icily at MacDonald, but said nothing.

After a moment, MacDonald spoke again, this time very calmly and evenly. "Let me apologize, Lucien. I'm not questioning your integrity. And I don't want to seem like I'm pushing you, but I really don't see how anyone can stop these things from happen-

ing. It *is* inevitable now."

He paused again, but Lucien still said nothing. Casually, MacDonald added, "And of course if you can't see your way clear to do it, I can find other capable but probably much less ethical people who will."

"I've no doubt of that at all," Lucien returned with a sharp edge of coldness in his voice.

"Look, Lucien. There's nothing wrong with business getting involved in this research. The free enterprise system tremendously elevated the standard and quality of life in this country, and, with your genetics, it can do the same for the rest of the world, too!"

Lucien was glowering now as he retorted, "I'll concede the standard of living, but I'm not so sure about the quality of life. And it gave the world sweatshops and pollution and the collapse of the family and of our moral system to go with your garbage compactors and electric toothbrushes!"

A silence as thick as a Los Angeles smog settled over the dining room. Only the sound of Nancy munching her lettuce penetrated the silence.

Finally, MacDonald said quietly, "You're right, Lucien. Those things did happen and they're nothing to be proud of, but they happened through failures of vision by the men who brought about the advances. And the improvements in living standards also happened. We can only try to do better in the future, and we can only do better with better people—with people of vision such as yourself."

He paused for a reply, but Lucien said nothing. He was thinking of Wilson and the refrigeration room and of Hazel's shrill warnings and of MacDonald's ostentatious building and of the broken publicity agreement.

In the face of Lucien's silence, MacDonald continued. "If my company—and you—don't do these things, someone a lot less scrupulous than us will. At least you're aware of the social and ethical implications."

There was another pause and this time Lucien responded, the passion now faded from his voice. "I'm just afraid you're going to open a Pandora's Box here, Harrison. I don't know whether you can control what gets out."

"The Box is already open, Lucien, and only you can control what gets out."

The waiter arrived with the main course—stuffed pheasant under glass with a side dish of french fried onion rings for MacDonald. They ate in silence as Lucien's mind played with the imagery. The Box was indeed already open and Lucien could see the demons and devils frolicking about in the ethical structure of society. But the last spirit to emerge from Pandora's Box had been Hope, and in Lucien's mind Hope now emerged and gained the ascendancy. Hope—and dreams. Glorious dreams! The equivocating philosopher receded; the inquiring scientist came forth.

"You've got yourself a deal, Harrison. But this time let's use my lawyer to write up the agreement." ■

UNIVERSITY MEDICAL VERSUS DIPLOCOCCUS PNEUMONIAE

DENNIS LATHAM COX

Remember "Legal Rights for Germs?" in the November 1977 issue? Now read the counterattack.

a major setback came to the Legal Rights for Germs Movement when the Medical Court at the University Medical Center today passed a decision against the Diplococcus pneumoniae bacteria in an assault suit filed by patient Edward L. Kosanovich.

The bacteria was charged with willful assault with intent to sustain great bodily harm. Doctor Elizabeth J. Robinson headed the team that carried out the sentence of execution on the bacteria by injecting the patient Kosanovich with certain select antibodies that are known to be lethal to it.

Kosanovich stated that he had first felt a chill, then developed a fever and a pain in his chest, and had finally begun coughing up blood. It was then that he was admitted to the University Medical Center for treatment.

Ever since the controversial Germ Decision, it has been necessary for a Medical Court to convene to establish the legal basis for treatment, as it is now illegal to execute any germ form, such as a virus or bacteria or fungus, without due process of law.

Doctor Robinson testified that the patient Kosanovich had three segments of his lungs become solid and airless as a result of inflammation. She also testified that the patient developed signs of cynosis, a bluish coloring of the lips, fingers, and ears caused by blockage of the free flow of oxygen to the blood in the inflamed areas of the lungs.

She further reported the appearance of an abnormal physical feature in the chest, which is brought on in cases of attack by pneumonia bacteria. Also entered into evidence was the lab report showing a high white blood count, and several X-rays showing a distinct shadow in the chest area.

The defense, led by attorney Charles P. Sorenson, countered by insisting that all this was circumstantial evidence and did not indicate the exact identity of the assailant.

The defense seemed on the verge of victory, when a surprise witness was called, in the person of one Janet Cramley, a lab technician at the University Medical Center. She testified that she was able to isolate the assaulting agent and had taken photographs of it in the microscope.

The photographs showed the distinctive dot-shaped pneumoniae bacteria and left no doubt as to the identity of the assailant.

Today's court decision grew out of a class action filed five years ago by Felix Gardener of Des Moines, Iowa. In that action, Gardener acted on behalf of all viruses, bacilli, etc., living in or on the human body.

Gardener had explained the basis of his suit by saying that every creature, however small, had a right to live its own life. He also stated that by bathing and by taking medicines to combat what he said the doctors called 'diseases' and 'infections' (something he referred to as slanted language), that we were killing billions and billions of living, experiencing creatures each and every day.

Gardener's class action resulted in it finally being set before the Supreme Court last fall. In the controversial 5-4 decision, since called the Germ Decision, Justice John W. Buchanan stated that "all creatures, no matter what their size or origin, have a right to a fair trial before they can be deprived of their life, liberty, or happiness." Justice Buchanan went on to say, however, that "no creature can be given free reign to bring injury, suffering, or death onto another living creature without being held accountable for its action."

The Pro-Germ movement had protested this decision because it still set up the "helpless" germs as targets of suppression, since they could still be brought to trial for some imagined harm to humans.

When asked about his suit against the bacteria, Kosanovich replied, "Look, I'm as peaceful as the next guy, but let me tell you, if some punk germ is trying to do me in, I'm not going to sit back and let him do it, you know. I got as much right to live as the next guy."

Doctor Robinson was quoted as saying, "Most bacteria are able to adapt to harmonious living with the human being. But there are a few malcontents that, thru the inability to live in cooperation with others, are harmful to humans. It is these socially maladjusted germs that make the whole germ race look bad in the eyes of the public."

Attorney Sorenson said, "This barbaric decision by the University Medical Court has slowed the progress of Germ Rights considerably. How are we going to convince other sentient life forms on other worlds that we deserve membership in their society when we cannot respect the sanctity of life forms by our brutal campaign of genocide of the germ race."

Sorenson was referring to Gardener's belief that flying saucers are interstellar spaceships carrying sentient beings from a higher civilization to our own, and that these beings have not contacted us because we show so little respect for life in all its forms.

The defense is expected to appeal.


VINCENT DI FATE

fixed price War

If modern technology makes total war impossible what does it do for limited war?

Charles Sheffield

As the sun set, the first line of attackers came silently over the brow of the hill. They were the scouts, shadowy figures moving with no apparent coordination down to and across the river, on to the waist-high savannah scrub on the near side. When the last man was across, the second wave appeared, a line of hover-tanks with chopper cover, advancing at no more than walking pace. The counterattack waiting until the tanks had reached the river. Then a bright mesh of ruby pulsed-laser beams lanced out from the nearer hillside, probing for the soft underskirts of the hover-tanks and the chopper rotors. Yellow and red tracers replied. The air became a multicolored confusion of stabbing pencils of light, smoke from burning vegetation and the fitful glare of crippled tanks and choppers.

Suddenly the whole hillside was lit by an intense blue-white fireball, spreading from a point close to the river bank. It grew rapidly, changing color to a greenish-yellow.

Merle Walters gave a grunt of surprise, leaned forward and hit a button on the console in front of him. The display stopped, frozen with the fireball about forty meters across. He swiveled in his chair and pressed the intercom. "Franny, get Alex Burns on the line. I think I've finally caught him."

He waited impatiently as the connection to Redondo Beach was made, looking at his watch as he did so. Eight-thirty, that made it five-thirty in California. Alex would still be around. When the intercom buzzed he reached out his right arm to pick up the phone. The left sleeve was empty, pinned to his dark jacket. As he placed the receiver to his ear, the screen lit up to show a trim, ruddy-faced man in his early forties.

"Alex, I think you've finally goofed." Walters grinned in triumph at the man on the screen. "If I had another arm I'd be rubbing my hands together here. I'm reviewing the simulation you've done for Exhibit Three of our proposal. One of your boys has gone wild and thrown in a tactical nuke. You know that's right out."

"Mr. Walters, I invite your attention to Page 57 of the Work Statement of the Request For Proposal." Burns answered in the careful speech of an Inverness Scot, unchanged after sixteen years in Southern California. "The RFP very clearly states, and I quote: 'Although nuclear weapons may not be employed, clean imploders up to 1,000 metric tons TNT equivalent may be used. No more than three such devices will be available in any single engagement.' The fireball that you are looking at in Exhibit Three is a new Morton Imploder, type four, one hundred and fifty TNT tons equivalent."

Alex Burns's face showed the slightest trace of a smile. Merle Walters looked at the display screen, thumbed rapidly through his copy of the Request For Proposal, and swore. "Alex, you Gaelic bastard, you did that on purpose. Don't deny it. I've known you too long not to recognize your touch there. Tell your lads the simula-

tions are damn good—but I'd like them a lot better if you'd put some faces on the attackers. All I can see is blobs."

Burns nodded gloomily. "I know, Mr. Walters. I feel the same way. But the people at GSA won't say who we're fighting and I can think of at least four possibles. Maybe you can get something for me at the bidders' conference."

"I'll give it a try, Alex—but don't hold your breath waiting for it. I'll be honest with you, that won't be my top priority at this bidders' session. There's something else I have to get an answer on. The Contracts Office have been like a bunch of clams on this one. Jack's trying a little line of his own to get information—we'll tell you tomorrow how it works out."

Burns nodded again. "Goodnight, Mr. Walters. Maybe I could suggest that you should call it a day. You're looking very tired. Trouble with the resumés?"

"As usual. We need two or three good production men, all we can find is a bunch of retired colonels and generals. Keep up the good work on the simulations, Alex, and I'll call you about noon—our time—tomorrow."

Merle Walters broke the connection and leaned back in his chair. He rubbed his hand over the top of his bald, furrowed forehead. Alex was right. He was damn tired. Alex couldn't usually catch him that way. And with just ten days to go before the proposal was due, with all the costing still to be done, he'd better keep something in reserve for next week. He spoke again into the intercom.

"Franny, I'm cutting out. Pull a bunch of those resumés together for me as bedside reading, will you? Remember, I won't be in first thing in the morning. Jack and I will be down at 18th and E Streets, at the Bidders' Conference. I can't be reached there."

He levered himself to his feet and walked to the outer office, limping slightly. He could disguise it if he tried, but it was pointless in front of Franny. She knew him better than he knew himself. She had the resumés all ready for him—probably had them ready two hours ago. Her plump, pretty face was set in what he thought of as her 'take your medicine like a good little boy' expression.

"Mr. Walters, I discussed this earlier with Mr. Tukey." She held out a locator. "If you'd carry this about with you, it would be so much easier for us to get messages to you. Look, this new one only weighs an ounce—and it's only an inch wide, it wouldn't be any trouble."

He looked at it, then peered at Franny from under his thick, grizzled eyebrows—his sternest expression. "Franny, I've told you once and I'll tell you again. I'm not going to wear a damned beeper. It's an invasion of privacy. When you see Jack Tukey tomorrow, you tell him exactly what he can do with that thing. Tell him it's only an inch wide, so he shouldn't have any trouble." His gray eyes twinkled

beneath the bushy brows. "Goodnight, Franny, and thanks for another day."

He went slowly out into the chilly November evening. Ten minutes later, Franny locked up and left also. The Washington office of WAWD Corporation was closed for the night.

The Bidders' Conference was scheduled for 9 AM in the biggest Conference Room of the old Interior building. Merle Walters was there by 8:45, watching the arrivals. About a hundred people. Say two per company. So fifty groups interested in the procurement. Merle knew the real competition like the back of his hand. Three groups, and WAWD. The other forty-six were innocents, flesh-peddlers, or companies looking for subcontract work. When Tolly Suomi of VVV Industries arrived at two minutes to nine, Merle followed him in and sat in the same row. Suomi looked his way and inclined his head. Merle had no doubt that Tolly knew the real score as well as he did.

Biggest Conference Room, so more than a twenty million dollar job. Coffee served, so more than fifty million. Merle read the signs almost subconsciously, the pricing signals that only the pros could read. Then Petzell would be running the Government side, for a job over five hundred million dollars.

Merle was sitting smugly on that train of thought when the senior government man came forward to the podium. Instead of Petzell it was his deputy, Pete Wolff. Merle sat up and took notice. What the hell was going on? He'd been tracking this procurement for a year, sniffing it and sizing it. He'd been pegging it at about a billion two. Surely they couldn't have missed the mark so badly? He leaned forward to cach the opening remarks, ignoring the stab of pain in his left side.

"Good morning, ladies and gentlemen." Wolff looked around at the sea of faces, old friends and old enemies. "I want to begin by running over the procedures we will be following on questions and answers. First, though, I should tell you that I'm deputizing today for Howard Petzell." He looked around with a slight smile. "He is home today with a bad case of the 'flu."

Merle leaned back, then looked across at Suomi. He was sitting there with a half-smile on his face, stroking his gray beard with one finger. Chalk one up to VVV's intelligence service. Suomi had known about Petzell's illness in advance.

Wolff closed the opening preamble with the usual warning about staying away from the technical men in the Government until the award was announced. Well, why not? Anybody who didn't have all his sources lined up well before the Request For Proposal hit the streets was a dead duck anyway.

Wolff came at last to the guts of the meeting. "We will now answer the questions from prospective bidders. All questions have been submitted in

writing in advance. All answers will be given in writing to all attendees. Will you please identify yourselves as you read your questions. First question, please."

"Jim Peters, Consultec. How will you be applying the Equal Employment Opportunity Clause in this job?" The speaker was well-known to Merle. From his Baltimore offices, Peters could be relied on to find a few hundred talented mercenaries for any job.

"As far as feasible. We know it's not easy for any of you. We don't expect an exact split, but we do want to see some WASPs in there. We can't accept a bid that's all blacks and Puerto Ricans. And we'd really like to see some minorities up near the top of your team, not just a bunch of retired West Pointers. That answer it?"

Peters shrugged. Wolff and the other government men knew his problem well enough.

"Next."

"Oral Jones, Rockdonnell Industries. It's not clear from the Request For Proposal how much Government Furnished Equipment we should assume. Can you give us any guidance?"

"It's been left open. It's up to you. Use GFE for anything, weapons, food, medical supplies, if you want to. Bid it yourselves if you think you can get it cheaper. We'll be happy to give you our price lists so you can see what we pay."

Merle sniffed. Dumb question. Nobody could undercut Government prices on supplies, unless they were buying stolen goods. GSA insisted on the best prices in town from everybody. Merle waited for the real action to start.

"Warren McVittie, Lockheed. I have a question on types of bid."

Merle noticed that the Lockheed and the Rockdonnell reps were sitting in pairs. Jack Tukey was over on the left-hand side, well away from Merle, where he could keep an eye on Suomi's crack salesman, Vince Menoudakis, and also on the men from Lectron Industries and Lockheed. He and Merle were careful to remain well apart, to get independent views of the meeting, and Tolly Suomi and Vince Menoudakis followed the same logic. Merle also noticed that the Lectron and Lockheed men were not their most senior reps. Suomi's presence confirmed Merle's own feelings—that this meeting was going to be a real ground-breaker. Top men should be there. Score one point against Lectron and Lockheed.

"The bid request is not clear," went on McVittie. "On Page 24 of the RFP, there's a note to say that bidders may choose to quote cost-plus or fixed price. That's a new clause for this kind of procurement. Are you actually inviting Fixed-Price bids for the whole job?"

The action had arrived. Merle Walters leaned forward intently. This was one of the questions he had come to hear an answer to. Wolff looked a little uneasy, and paused before he replied.

"Just what it says. Bid it cost-plus-fixed-fee, cost-plus-incentive-fee, or fixed price. It's up to you. I think I should tell you that, other things being equal, fixed price bids will be favored." He stopped, than apparently felt obliged to add another comment. "I know it's new, but this will probably be our policy in the future on this type of project."

Fixed price. A whole new set of parameters to worry about. Merle sat, deep in thought, until he was roused by Jack Tukey's voice.

"Jack Tukey, WAWD Corporation. I'd like to ask about deliverables, especially in view of what you said about a preference for a fixed-price contract. What are the project deliverables, and how will they be evaluated?"

"If you bid fixed price, there's only one real deliverable. The overall tactical position at the end of the contract period must be acceptable in territorial holdings. We realize this gives you problems in bidding, since we can't at this time reveal to you the exact area where the engagement will be fought. However, this deliverable will be developed in detail during the final contract negotiation, when a vendor has been selected."

Nasty. In other words, you're bidding it blind, fellers. And if you won't play the fixed-price game, you probably lose outright. Some smartie in the Government was being super-tricky. Merle tried to fit it together.

"Vince Menoudakis, VVV Industries." The voice was soft, with a slight trace of a stammer. Merle awakened again from his trance. He always liked to see an artist at work, and Vince was one of the great ones. "Mr. Wolff, the geography makes a big difference to the cost of the action. You know that just as well as we do. Now, wouldn't it save the Government money if the bidders could be told the fighting area? There would be less work for you in negotiation, more precise bids from each of us, and a bigger effort on our part to get the really best strategies for the terrain. Where will the project be located, Mr. Wolff?"

Merle smiled to himself. In five or six sentences, Vince had somehow done his usual stroking job. How did he do it? Wolff was smiling and nodding responding to some mysterious warmth in the questioner. Menoudakis, if he were available, would really be a catch for WAWD. Earlier tries proved that Tolly Suomi knew it. He had Vince pretty well locked in.

"Yes, it would certainly save time later. Our main area—," Wolff actually began to reply before he realized what he was doing. He stopped. "Our main area is—roughly in the latitude range 15 to 25 degrees, as it says in the Request For Proposal. That is as far as I can go—after all, Mr. Menoudakis, war has not yet been declared. We don't want to start an international incident here, do we?"

Nice try, Vince. Pulling an area out of Wolff wouldn't have helped VVV much—everybody else would share the information. Suomi had gone along with it just to rub in to the rest of them what a master Vince Menou-

dakis was. Jack Tukey had hit the nail on the head the first time he had met Menoudakis at a debriefing. "I don't remember what he said to me, Merle, but if he'd asked me to marry him I'd probably have agreed."

The meeting broke up at about 11:30. Merle and Jack Tukey shared a cab back to the WAWD offices on Wisconsin Avenue. They had lots to talk about. Jack had news on the evaluation procedure, straight from the horse's mouth: Petzell's secretary.

"Do you realize I was in the Embers with Lottie Mitchell until two o'clock this morning? I'm telling you, she nearly drank me under the table. I should be getting danger money for my liver. I had seven bourbons and then I just lost count—and Lottie didn't have a hair out of place. Then we went on over to her apartment, and you won't believe this but at half-past-three I found myself doing—"

"Jack, I should get money from you for introducing you to Lottie in the first place," interrupted Merle. "Stop stringing me out, and get to the point. I'm well aware that you do it on purpose."

Jack Tukey grinned. It was a pleasure to see Merle rise to the bait. "All right, if you've got no romance in your soul. It's going to be a four-man review board. Technical evaluation will count 40 points, price 60 points. Now for the bad news. This one's going fixed price, or nothing. Lottie says there's no way they'll give it out on a cost-plus basis. Where does that leave us, Merle?"

Walters looked out at the leafless November trees on Pennsylvania Avenue. "In deep shit, my boy. In up to our necks." He spoke quietly, almost abstractedly. "You know, we've never tried to be the low dollar man on these bids. WAWD offers quality. But I don't know if we can do it this time. Six outfits underbid us. They'll not be a patch on us technically. But you heard those deliverables. Completely undefined. Have the status half-way right after a year, and you'll get paid. And an option to renew for another two years. Doesn't matter how shaky the field position is, as far as I can tell." He fell silent as they drove through the rutted streets of Georgetown. "I'm telling you, Jack. Some half-wit's dreamed this one up to make his name in the Government. We've got to think of some way around it. Fixed price war, is it? What's our edge now?"

He was silent again for a few minutes, then nodded. "When we get to the office, Jack, call up Lottie and make a date for tonight. Most of all, I have to know *where* this war will be fought. That's the top priority. Location, and combatants. We've got a six-month job ahead of us, and two weeks to do it in. You'll have to risk your kidneys again. And one other thing. I need to know how they'll be auditing this one. If it's genuine fixed price, there shouldn't be any Government audit of it at all."

Merle sat slumped in the car seat, staring into space. His right hand rubbed the shoulder of his empty

sleeve and his blunt features were twisted in thought. Jack thought how much the old man was aging, how ill he looked. Maybe this effort was just too much to ask of him.

Merle glared at him, suddenly alive again.

"Stop gawping at me like a half-wit, Jack. When we get to the office, I want to talk to CBS and NBC. You handle ABC. Here's the way it goes."

Jack felt a surge of relief as Merle outlined his plans. Down but not out. As usual, Merle seemed to have found his angle.

"Can we price it low enough, Merle?"

"If it works out the way I'm hoping, we can underbid everybody in the business. I want you to fly out to the West Coast tomorrow night and bounce the main ideas off Alex Burns. He's key to this. I'll find somebody else to woo Lottie in your absence. Maybe I'll recruit Vince Menoudakis for the job."

Jack sniffed. "You'll be doing Lottie a disservice. You know these high power sales types. Lots of promises—until it's time to deliver. Then they don't have what it takes. Tolly Suomi, he's the man for my money."

"You don't have that much money, Jack. Here, give me a hand to get my stiff leg out of the cab. I feel like Pinocchio today."

The air was full of gray sand and black smoke, blinding the soldiers and blotting out the fierce desert sun. Tanks were barreling forward through the dust, a group of men with combat lasers following each one. The long, high scream of an omniprojector was approaching along a dry wadi, and a Clarke neutralizer was turning to meet it, lobed antennae moving into exact phase for cancellation. The operators of the neutralizer were tunneling deep into narrow trenches in the sand, reading the strength of the omniprojector signal on the dials set in their helmet displays.

"Mr. Suomi calling on line one, Mr. Walters."

"At last." Merle grunted in satisfaction. He left the screen display running, reached over and picked up the receiver. Tolly Suomi's bland, unlined face appeared on the intercom screen.

"Perhaps I am calling at an inopportune time, Merle. It sounds as though you are tuned to the NBC news report. Should I call back later?"

"No. I've been trying to reach you all day. I asked your office to find you and give you the message to call me. Where are you, Tolly?"

"Newark, New Jersey."

"Can you be here in Washington, tonight?"

Suomi's face, as usual, betrayed no curiosity or surprise. "I can. By seven o'clock at the latest, perhaps by six-thirty."

"I'll be here." Merle broke the connection and leaned back in his chair, looking for a comfortable position.

On the screen, the Clarke neutralizer had been homed on by a seeking missile and was out of action. The

omniprojector was advancing again. Men fell before it, flopping and convulsing like landed fish as the vibrations tuned to their central nervous system frequencies.

Merle watched as the NBC newscaster summarized the day's fighting, the advances and retreats. It was on the nose with his own scratchpad estimates. He placed a call to Alex Burns and sketched out a scenario. Alex objected to some of the ideas, and they went at it hammer and tongs for the rest of the afternoon. When Suomi arrived they were still arguing. Merle waved him to a seat, fired a final salvo, and cut the connection.

"Never try and argue with a Scotsman, Tolly. Stubborn as donkeys. Must be the oatmeal."

Suomi smiled, smooth white in smooth ivory. "Alex Burns?"

Merle nodded. "You know him, do you? He's right again, blast him." He leaned back, his voice a bit too casual. "Had any chance to see much of Alex's work? I was wondering what you think of him."

"The same as you do, Merle. Not just the best, the very best." Suomi smiled the Tolly smile, a fraction of an inch elevation of the corners of his mouth. "Don't let's be coy, Merle. You know quite well I've tried to hire Alex Burns from you. Probably as many times as WAWD has tried to steal Vince Menoudakis—and with the same success. Nothing."

"Tolly, I don't own Alex. His job does. Get ahead of us on the simulations, and Alex would take a job with VVV tomorrow to find out how you do it. I couldn't hold him a day."

"And how to do that, when Alex Burns leads the world on simulation mock-ups." Suomi waved his arm at the display screen. "He's an artist with that thing. He can make it more real than reality. Burns is an artist the way Disney was, posing as something else. I'll tell you, Merle, I've needed an Alex in the past six months."

Merle nodded, his eyes averted. "Aye, it's been a hard time for all of us, Tolly."

The reaction was a Suomi maximum. One eyebrow raised a fraction of an inch. The sign of strong emotion. "Hard? When you've won the last four war jobs, in a row? Merle, I'm not here for social reasons. I dropped everything to get here today—just as you knew I would. We've been running in circles since the November bidders' conference, trying to find out how you can price the way you do and still make money. We've got our sources in Contracts Departments, same as you—and we still don't know how you do it."

Merle smiled, rubbing his left shoulder in his habitual gesture. "You're not a poker player, Tolly. You show your hand."

"I'm a chess player, Merle. I can tell when somebody is planning seven moves ahead and the rest of us are playing six. We've been competitors for a long time, the two of us. For fifteen years we've been neck and neck. Now, what's your secret?"

"You know, don't you, that we

sewed up the TV rights for the Trucial War with NBC? That was a twenty million dollar deal, just for special footage."

"I know. It was a neat idea, putting it on the same basis as the Olympics—but I know that's not your trick. We caught on to that last Christmas and now we use it in our bids too." Suomi placed his hands flat on the desk between them. "The real thing, Merle. What will it cost me to get it? You know I'll find out anyway, if I stick at it. And VVV won't go broke without it. But you have to know what it feels like to lose four big ones in a row. Name your price, I'll pay it."

A lengthening silence. Merle looked out at the gardens far below, dusk falling over the bursting azaleas of early May. "You seem sure of yourself, Tolly. Got an insider in our accounting department?"

"I don't need that, Merle. Look at this office." He gestured at the furniture. "The better you're doing, the cheaper and lousier the fixtures. I daren't sit down too hard on this chair in case it falls apart. Come on, Merle, let's get to it. What's your price?"

"I've got my price, Tolly. Here's the ticket I'm selling." He reached into his suit pocket and pulled out his wallet. From it he took a sheet of paper about seven inches square. "That came to me yesterday."

Tolly Suomi read through it, caught his breath, and read it again, slowly. At last he lifted his head and looked Merle Walters straight in the eye. "How long, Merle?"

"You tell me. The medics can't seem to agree. One month, six months, two years. From now on, it's a game of roulette. Good thing Jack Tukey's ready. He'll make a good president for WAWD." He paused expectantly. "Don't you agree, Tolly?"

Suomi hesitated, for the beat of a hummingbird's wing. "An excellent president, Merle. He has a good business head, he eats work, and he can pick the right people—and keep them, too. Jack will make a good president for WAWD—a great president. In ten years' time." His voiced raised a little. "You see, Merle, we've met, what, thirty or forty times over the past fifteen years? Most people wouldn't say we're close. But I think I know you as well as you know me. Jack Tukey has one failing, but it's one you can't live with. Jack doesn't hate war—yet—as Merle Walters hates it. He doesn't hate the stupidity of it, the cruelty of it, the very idea of it."

Merle bowed his head. "I'm a war hero, Tolly, didn't you know that? To a lot of people in this country I'm Mister War himself. Generals are proud to shake my hand. I got this—" He gestured at his empty sleeve and left leg. "—being a hero, forty years ago in the Pacific. Fighting your countrymen. No, it's Tolly Suomi that really hates war, I would say. You remember World War Two, Tolly?"

"I was eight years old when it finished, Merle. I remember it. I lost no arm, no leg. But I was on holiday in the country, when my family was

home in Nagasaki. I remember that. And other things. I remember your cost-benefit study, showing that napalm is not a cost-effective weapon of war. How much did that study cost you, Merle?"

"Enough so no one would question our results. And VVV Industries' analysis, showing that antipersonnel fragmentation bombs aren't a good investment of war capital. How much did that one cost you, Tolly?"

"As you say, Merle, enough. Vince did a marvelous sales pitch on that one."

"The next president of VVV, Tolly? Would Vince want it?"

Suomi looked quizzically at Walters and waved the thought away. "You don't hire Liszt and ask him to move pianos. Vince is an artist, too. He has something we can't analyze—no place for it in chess or poker. People like him, he likes them, he sells them. Never fails. He's right where he is."

Merle nodded quietly, rubbing the side of his face with his hand. The two men sat in silence for several minutes. Finally Merle spoke.

"So now you can guess my price, Tolly. The price for the secret, the way we can underbid the market, every time, on the fixed price war jobs. Only one way I'll accept payment." He gestured at the photograph of Lyndon Johnson, hanging on the wall. "Know why I've got that picture up there, Tolly? I'll tell you. He's the man who turned me from a hawk to—what I am. I lost two sons in Vietnam. Two boys, too young to vote, to feed the ego of a man who wouldn't ever admit he was wrong.

"Merger, Tolly. Merger, with you at the top. Vince Menoudakis as VP of Sales, Alex Burns as VP of Production. And Jack Tukey, as Executive VP, waiting in the wings. Your time will come, too, Tolly, and Jack has to be ready. And maybe I'll be around here for a while yet, as a high-priced easy-life consultant for you—when you need stirring up a bit. Life's not chess, and life's not poker, but there's some of both in it. Merger, Tolly. Let's talk terms."

Suomi sat, face expressionless, one hand stroking his beard. "Perhaps. Perhaps. Would Jack Tukey work for me?"

"He thinks you walk on water, Tolly. So does Alex."

"Suppose I agree, find out how you operate, then back out?"

"That's tough titty for Merle Walters. A man either goes along with his judgment of people, or he's got nothing. That's the least of my worries, Tolly."

Suomi was nodding slowly. "My ancestry and education prepared me for this, Merle. There has been something that year by year has bound our fortunes tighter together, two caterpillars in one cocoon." He held out his hand. "Agreed in principle—details to be worked out. I hope we both live to see an end—to the lawyers putting the groups together. It will take a while. You control a stock majority, I hope?"

Merle nodded. "As you do. I did a

little tracing of the lines on VVV this morning."

"Then it can be done. So now, Merle, tell me. Tell me something that has been on my mind every spare minute for six months. You are bidding fixed price and you are thirty percent lower than the rest of us. How are you doing it?" Suomi was leaning forward intently.

Merle opened the credenza behind him, pulled out a bottle and two glasses. "Champagne, Tolly. Let me savor the moment. You'll have to open it. It takes two hands."

"You were that sure of yourself?"

"Either way, I would drink the champagne. Take a look at this."

He turned on the display screen. The picture filled with scenes of battle, again in the desert. The heat, the smoke, the noise, the chaos, almost the smell seemed to spring from the screen.

"Now, Tolly, what are you seeing?"

"The Trucial War. I don't know which action. Last week's, maybe, up on the border."

Merle smiled and raised his glass. "You've got a great eye, Tolly. It's the Trucials, it's even a border skirmish—but it's next week, not last week. You said that Alex Burns is a genius. I agree. Half the battles in that war never happen. They're Alex's simulations. We ship the footage to NBC—they pay for it—and they weave the commentary around it. Much better for them, they don't have to keep a camera team out in the field. About half the footage is genuine fighting. The rest is Alex."

Suomi's eyes were flicking from the screen to Merle and back again. He was running rapidly through the difficulties, the possibilities. "How can you meet the deliverables? How can you pass an audit?"

"No audit. Fixed price war, remember? Deliverables? We maintain the lines we promised—you know, these aren't wars to win, they're to hold the status quo. We find the bidders on the other side, as early in the game as we can. We agree what will be fought, what will be simulated. They buy the simulations they need from us—a tidy profit there for WAWD. We have to mix it up, in case there are parties of journalists or junketing politicians. They see genuine battles. How can somebody tell if the other battles they see on the screen are real?"

"And you make a profit?"

"Thirty-five percent. No matter how much the simulations cost, or how much it takes to keep things going smoothly, *nothing* costs as much as a war—even a small one. One other thing, Tolly. Go and take a look at the war hospitals. There are still deaths, because there are still battles. We stopped the worst maiming a while back, the two of us, when we got rid of the worst weapons. Now, the injuries are down again—and WAWD gets credit for tactics and brilliant fighting."

Merle Walters raised his glass again. "Here's to the merger of WAWD Corporation and VVV Indus-

tries—the War leaders. You'll have to keep up the struggle now, Tolly, until some day maybe we'll get some sense. I'm not optimistic. We're aggressive animals, the lot of us. But here's to War, damn its soul."

Tolly Suomi was thoughtful. He flexed his shoulders, feeling a new weight there. At last he too raised his glass. "To the merger. And to our motto: War is much too serious a thing to be left to the Government."

The glasses clinked. On the screen in front of them, the battle raged. ■

TIME AND SPACE:

It seems obvious that a science fiction writer will write mostly about time and space—beyond known limits. That's where high romance, in the larger meaning of the term, has to be laid.

This wasn't always true, in the sense we use time and space. There was a time when most of mankind—even the reasonably educated part—was restricted to a very limited here and now. Far Cathay was only a legend, the Ind was something from fables, and often any place more than fifty miles away was a place where anything could happen. And the past was even more fantastic; a few men who studied what history was available knew better, but to most people the great medieval romances, with their wonder and magic, were the true past.

Now the Earth is a shrunken sphere, and its essential dullness is laid bare in all our history of politics and poverty and plague. There is no place for High Brasil, no period when Arthur kept his court of chivalry.

Yet the need within us for high romance is perhaps greater than ever. Apparently, we still have an urge to lift our eyes to far horizons where wonders exist, and to thrill to the deeds of men who are larger than life. There is no place or period left unexplored for them. So we must make a place. And we do—in the relatively unknown future, and across space where worlds of wonder may exist. There all limits, except for reasonable credibility, are off. Thus writers are unlimited, one might suppose.

But in a different sense of the words, both time and space have been severely limited for most writers in our category. There has seldom been time enough to write the kind of story that should be written; and until very recently, there was never enough space within the limited pages of the novel.

At the rates that were paid for such fiction, a writer who wanted to eat regularly had to turn out a fairly high volume of fiction. He couldn't afford to spend the time to shape a story exactly in his mind, then write and rewrite until he was sure it was the best he could do.

And there were severe limits on how long a novel could be. Most serials ran in a few installments, and one that ran to about 60,000 words was considered the best length. That could be broken into three parts, each leaving room in the magazine for the other stories needed to make the contents page attractive.

In books, about the same length was considered ideal for all category fiction. This was particularly true for the paperbacks, where the standard length for a novel for many years was a mere 160 pages—and some were shorter.

Happily, the current science fiction boom seems to have made the need for haste and brevity less pressing. At the current rates of payment, it's possible for a writer to take months, rather than weeks, to write a novel and still make an adequate living, at least. And despite the rising costs of paper and

other factors of publishing, the publishers have finally discovered that bigger novels, where the writer can develop his theme fully, actually may sell better than stripped models.

This should make for better fiction, though it takes time to break old writing habits. But already, there are signs that some writers are beginning to take advantage of the current opportunities.

Most certainly, Gordon R. Dickson has done so in his most recent novel, **The Far Call** (Dial Press, $9.95). This is a fat, full book. It's also the third in the Quantum Science Fiction line, and the first for which I could work up any enthusiasm.

Readers of Analog may find the title familiar. The novel was originally a serial back in the fall of 1973. But while much of the basic plot of this book is the same, the novel has undergone such extensive reworking that it deserves to be treated as a new book. It's a good example of something that doesn't happen too often—a published story which the writer felt he could improve and which he then took the time and effort to redo completely.

After all, the requirements of a serial and of an independent novel are different in many ways. The major difference, of course, is that the serial must break into sections, each designed to hold the reader and carry suspense of some sort for the long wait between installments. But a novel should be continuous, building naturally toward its climax, with the theme usually more important than the action sequences. A book is read continuously, after all. And while many serials (and even series of novelettes, often with artificial endings to each story) have been printed in books as novels, there is almost always some sacrifice in depth and development.

This is still the story of the first manned trip to Mars, against handicaps created by world conditions, politics in and among nations, and perhaps the last chance for the human race to face the real challenge of space. It was a good story originally, but it's a much deeper and more convincing one now.

To some extent, Dickson has adopted a "mainstream" method of telling the story. The emphasis is much more strongly on character and the cross-currents of human beings in conflict, both petty and grand. The political struggles are no longer background, but are developed fully and become a sustained and integral part of the story. And the main character is Jens Wylie, Undersecretary for Space Development, fighting to save the mission that his government seems to regard as a mere propaganda tool. It places most of the suspense elements here on Earth, rather than in space, though there are enough gripping scenes aboard the Mars ships. Still, while some of the technique and development are those of contemporary fiction, the spirit and theme are unquestionably pure science fiction.

There's a large cast of characters, but in nearly all cases there is no difficulty in keeping them straight; they are largely self-identifying, as they should be. And there are plenty of subplots, so often lacking in science fiction; these relate to and deepen the main point of the story.

(Minor quibbles: I'm not at all convinced that the US astronaut would become radioactively "hot" from the

type and obvious dosage of radiation he received, though the injury is believable; the gravity on Mars is three-eighths Earth-normal, not three-fifths; and I'm a little surprised that China was not one of the political divisions sending an astronaut. But none of these small details in any way harms the story.)

It's the most mature of all Dickson's novels. It may well be his best. A fine novel, recommended to every reader.

Well of Shiuan by C. J. Cherryh (DAW Books, 256 pp., $1.95) is further proof that Cherryh is one of the most capable of the newer writers in the field. Her sure command of character, background, and mood mark her as one of the real stars of the science fiction adventure field.

This is a sequel to her first book, *Gate of Ivrel*. In that, we met Morgaine, a strange, dedicated woman who was traveling from world to world with the mission of destroying the Gates that had been built by another race to permit instant travel between worlds—and which were destroying the worlds on which they stood. With her was Vanye, an exiled clansman who was Claimed by her—made her bondsman with no rights except to do her bidding. They had stepped through a Gate just before it was closed forever, into another world.

This is the story of that second world. It's a dismal world, one where the seas are rising, flooding out the land and ruining what civilization was attained by those who had originally come through a Gate and occupied it. Adding to the chaos of the constant rains and rising sea is the unstable nature of what land remains, beset by frequent earthquakes. And it's a savage place in many ways, with little time for anything except the struggle to survive. The only hope for humanity would be to escape back through the Gate; but everything about the Gate has become a fearful, superstition-haunted legend.

Morgaine and Vanye must make their way through natural disasters and the scheming of the lords who rule one of the few reasonably secure sections. They are beset by mobs who are escaping disaster and blaming them for that disaster. They seek, of course, the Gate.

I don't find the world here nearly as interesting as that of the first book; it does not offer the varied possibilities for cultures and backgrounds that the other world had. The scenes are well depicted, the cultures believable, but the grimness of everything makes it all somewhat of a one-mood performance.

The characters are another matter. Jhirun, the girl who flees her hopeless homeland to accompany them—often against their wishes—is fine, as is the seemingly effete, unreliable Kithan, second son of the ruling lord. Morgaine is fascinating and complex, and Vanye grows in character.

Most interesting, however, is a character who is on-stage only briefly. This is Roh—by body, a cousin of Vanye; now he is the body occupied by one of the race that built the Gates, or at least used them to the ill of the universe. As such, he should be completely evil, a creature that has become nearly immortal by moving his essence from body to body in his never-ending quest for power. And yet, there is much of the honest decen-

BIOLOG

by Jay Kay Klein

Algis Budrys

"I was essentially doomed from birth," said 'Algis', speaking of how he became a writer. Now acclaimed by many fellow practitioners as a writer's writer, Algirdas Jonas Budrys spoke Lithuanian as his first language, later adding German and French. He was born in 1931 in Koenigsberg, East Prussia, where he was to see Adolf Hitler parade past his house. His father was Lithuanian Consul General in Germany and later in New York City. In support of efforts to maintain a Free Lithuanian presence in America after Lithuania was overrun in 1940, Budrys served as his father's translator and media contact representative for over twenty years.

He has been a science fiction reader since age seven, receiving his first rejection slip when ten. He made his first sales, among them one to Analog, at 21, appearing in the November, 1952 issue.

Budrys attended the University of Miami (Fla.) and Columbia University, studying English, writing, ecology, and psychology. A number of editorial positions on science fiction magazines and other media, culminating in the editorial directorship of Playboy Press, led him to the Chicago area in 1961. He then concentrated on editorial, public relations, and advertising agency work. He's been back full-time writing since 1974, interrupted only by time out for SCUBA diving, local politics, vehicle testing, helping administer a soccer club, and bicycles. His basement is a bicycle shop where he custom builds machines for his wife and four sons. His own publishing company, Unifont, produced with Rand McNally a manual called Bicycles . . . How They Work and How to Fix Them.

He has written articles for such diverse publications as Esquire, The New Republic, Popular Electronics and Car Speed and Style, and book reviews for Books West and the Washington Post as well as the SF media. Budrys also has written fiction in several fields, although he says: "An SF writer is what I am." He won an Edgar award of the Mystery Writers of America in 1966. He wrote the movie scenario for Dinosaurus! (1960). His novel, Who?, was released internationally as a motion picture in 1974. Two SF paperbacks are coming out this year: his Berkley-Putnam novel, Michaelmas, and a short story collection, Blood and Burning, which also contains some of his suspense writing. He is currently at work on a long non-SF novel.

cy of Roh in his actions, whatever his motives.

The book ends satisfactorily, with the threads neatly tied. But I suspect that there will be another book in the series, and I look forward to further revelations of just what Roh's character really is.

I think this novel suffers a bit by comparison to the first, but only in the matter of variety. The writing is strong and the characters fully drawn and always interesting, while the plot moves with a steadily rising pace.

A good adventure novel with a lot of color. I enjoyed it.

Etidorhpa by John Uri Lloyd (Pocket Books, 350 pp., $1.95) is a curiosity, but a fascinating one. It's a sort of mystical fantasy, first published in 1895, dealing with a strange trip into "the heart of the earth." (Whether real or hallucinatory is pretty much up to the reader.)

I'm not too fond of most books that are reprinted from the last century; most of them turn out to be little more than historically interesting. But there is a fascination to this one, and the price makes it readily available, unlike most special printings of such works. The writing has a number of dated tricks about it, but it's a fairly good read. And Pocket Books has done an excellent job of reproducing the numerous original illustrations by J. Augustus Knapp. If you're curious about early works, this is a good book to try.

And finally, there's **The High Frontier** by Gerard K. O'Neill (Bantam, 344 pp., $2.75), with copious illustrations of hardware for life in space by Donald Davis.

This is obviously a must book for all those who are devoted to the L-5 project for making homes for mankind out in space. As such, it's a fine book, I'm sure.

I'm not sold on the whole idea, and this doesn't answer any of my objections very well. The economics are fuzzy as I see it. The problem of shielding is brushed off too easily with little coverage. And the idea of relieving population on Earth isn't convincing; settling America didn't exactly relieve the population problem in Europe.

Nevertheless, the book is interesting, and there are a number of ideas that deserve serious consideration. It strikes me as propaganda to some extent; but there's nothing wrong with propaganda—after all, without the propaganda of von Braun, Ley, Clarke and others, we probably would never have sent ships to the Moon. ■

Addendum: For those of you who have voiced concern about the direction the US space program is heading, and want to do what you can to influence NASA and the Congress to do more in space, there is now a How To book. It is **Lobbying For Space** by Robert A. Freitas, Jr. (published by Space Initiative, Box 353, Santa Clara, CA 95050, $4.20).

This is a thorough and informative guide for the concerned citizen who wants to know what to do, how to do it, and to whom it should be done. Everything from letter-writing techniques to "report cards" on every member of Congress and their space-issue voting. Recommended for reading. And action!

The Editor

Dear Ben:

Barry Malzberg in reviewing books in "The Reference Library" in Analog for October, 1977, has made references unfavorable to my books *Explorers of the Infinite* and *Seekers of Tomorrow* which he is unable to support. In comparing them to a group of other books on science fiction he made a special point of saying that they were "often inaccurate." When asked by me to list five or six points from the quarter of a million words of reference in both books he replied, stating in essence that he could not do so from his own experience and knowledge and referred me to the book *More Issues at Hand* by William Atheling, Jr. (James Blish). Examination of this book shows that *Atheling lists no errors,* in fact comments favorably on the fact that *typos* present in the first printing had been eliminated from the new one. While he disagreed strongly with interpretations in the book, Atheling (Blish) prefaced his remarks by stating that I am the "nearest thing to a scholar that science fiction has yet produced."

When later highly praising James Gunn's book *Alternate Worlds* (which I also highly recommend) Malzberg does not mention that the quality paperback edition which he is reviewing has a full-page listing 29 errors in the previous printing, which remain uncorrected. Yet he goes out of his way to say mine have errors, even though he does not of his own knowledge know what they might be.

This type of gratuitous slur is grossly unfair. A number of the authors of well-known books *on* science fiction have either written me or included in their texts quite honest acknowledgements that they have leaned heavily on my texts in the writing of their own. These include James Gunn, Brian Aldiss, and Dave Kyle among others. Further, despite the proliferation of books on science fiction, my works still contain reference material available nowhere else in the world in printed form.

Finally, Malzberg's thesis that there were hardly any books on science fiction in print and available when he entered the field in 1965 is open to challenge. Quite probably, in addition to my own *Explorers of the Infinite* and *The Immortal Storm,* book dealers could have supplied the interested with *New Maps of Hell* by Kingsley Amis, *In Search of Wonder* by Damon Knight, *The Science Fiction Novel* by Heinlein, Kornbluth, Bloch and Bester, *A Requiem for Astounding* by Alva Rogers, *The Issue at Hand* by William Atheling, Jr., *Voyages to the Moon* by Marjorie Nicholson, *From Utopia to Nightmare* by Chad Walsh, *American Dreams* by Vernon Parrington, Jr., *2000 Years of Space Travel* by Russell Freedman, etc., some in paperback.

SAM MOSKOWITZ

It's not unusual for critics—and even historians—to fail to agree. Both Malzberg and Moskowitz sent voluminous letters to Analog and each other as a result of Malzberg's October 1977 guest appearance in Reference Library. They have both graciously agreed to limit their public debate to this one letter in Brass Tacks.

Dear Mr. Bova:

In Brass Tacks for December, 1977, you printed an excellent letter on education from Andre Shumburger and asked the questions: "Who will teach the teachers? And their administrators?"

As a former teacher I believe I can answer those questions. Creative people. People willing to analyze a situation and change it if it so warrants. These are the people who not only *will* teach the teachers and administrators but who have already begun. People like Ed Peno and Dr. William Glasser. Glasser has a federally-funded program offered to teachers and administrators explaining his philosophy of "Reality Therapy" and an emphasis on the positive rather than negative aspects of learning. I myself was involved in a system of teaching based upon competency learning and I share Mr. Shumburger's hope that the 80's will be the "years of competency." But the problems in education are not solely those of methodology. Attitude, particularly of teachers and administrators, is the chief obstacle to overcome if we are to see anything but years of decadence. Unfortunately, it is much easier and comforting to exist in a world of stability, even if the stability is unproductive, than to branch out in new directions. Furthermore, those who feel threatened by change take to task those who would encourage it and revel in the occasional failures that inevitably befall the new, experimental ideas.

In a world of perpetual change too many educators have buried their proverbial "heads in the sand," content to teach using antiquated methods to youths who are literally living in another world. But in each pound of failure to change there is perhaps an ounce of success. Success, eventually, will be ours. It has to. What was it that Lincoln said about fooling the people? I think it's about time.

PAUL E. STAMSKI
5027 Caniff
Hamtramck, MI 48212

P.S. I have stated that I was a former teacher. Just so your readers don't get the wrong idea, I left teaching due only to economic reasons. $8,000/year is a little hard to live on. My physical presence may no longer be there, but my heart hasn't left.

Apparently it takes dedication, initiative, an open mind . . . and a living wage.

Dear Ben:

It's interesting that you began your editorial, "Courage," with a reference to "The Wizard of Oz." In recent years, public libraries, at least those in Florida, have been ordered by the state to eliminate the Oz books from the shelves. I tried to buy the Oz books from several libraries and was angrily rebuffed. "By God, we got orders to *burn* those books!" And burn them they did, thereby impoverishing the childhood of millions. What has

the Children's Book Council to say about *that?*

Re editorial fearlessness: Would an editor be justified in publishing an attack on anti-McCarthyism? It's curious that your example of the base actions of McCarthy is not something McCarthy did. It's what an editor did, based on his assumption as to what McCarthy would think. Perhaps McCarthy would have welcomed the book as a warning against Russia.

Nobody has yet had the guts to publish a pro-Hitler book—but they will in time. Consider Napoleon, who was equally considered a monster, but is now a hero. It seems that what constitutes propaganda depends largely on the bias of the observer. Nowadays, anything that parades as "Liberal", whatever that is, is automatically approved by a large number of people; "if it's Liberal, I'm for it, no matter how obviously stupid or unjust it is."

Relevence is irrelevant.

KEITH LAUMER

The Liberals are getting their lumps, with the growing Conservative "awareness" both in the US and in Europe. And although there haven't been any out-and-out pro-Hitler books published as yet, several recent books have taken the point of view that poor old Adolf was maligned, and wasn't really as bad as we thought he was. Librarians who burn the Oz books because they are "only following orders" from their superiors will probably make a good audience for pro-Hitler books.

Dear Mr. Bova:

The bleak society of "meritocracy" which forms the backdrop for Mack Reynolds' story, "Of Future Fears", is the latest in a lengthening list of similar grim forecasts that have appeared in Analog over the last few years. Analog's contemporary science fiction writers seem to share a universal pessimism about the future of American and world society.

Where are those wondrous visions of utopian fantasy, those marvelous pictures of a better world for us all that I seem to recall characterized the science fiction of an earlier era? The America of the not-to-distant future that has been pictured in Analog of late inevitably emerges as a sleazy, tacky, overcrowded society that wanders cattlelike through a gray, dull, welfare state existence, beset by numbing pollution, food riots, continuous mini-wars fought by mercenary soldiers, all-powerful multi-national corporations, and an uncaring and cynical government that has completely lost touch with the people.

I don't consider myself an optimist, but I can't buy a great deal of this pathetic scenario, and I find it growing tiresomely repetitious.

I'd like to make another point about Reynolds' story. It seems like every time his characters turn around, they've got a glass of booze in their hands. If they're not drinking one, they're pouring one. Alcoholism is a disease of epidemic proportions in this country, and I object to seeing it injected unnecessarily into a story. I can't see that it has any bearing on the story, but Reynolds obviously feels that to portray his characters as real two-fisted adults they must have a taste for the sauce. That's not a requirement for adulthood and it's high time we all realized it.

BILL SCOTT

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Panorama City, CA 91402

Few people outside the SF field realize that science fiction writers try to deal realistically with the facts of today and trends of tomorrow. If many science fiction stories paint a grim picture of the future, it's because the writers honestly see problems waiting there for us. Interestingly, most stories showing "rosy" futures are set farther in the future than the next 50 years or so. Apparently the consensus is that the next few decades are going to be tough. Not insurmountable, but damned tough.

Dear Mr. Bova:

When my January Analog arrived . . . I began with your editorial, on courage. It seems clear to me that you had a fine opportunity to exercise your courage by accepting Option (b) offered by CBC's attorney: you could have agreed to make your own legal defense of your right to speak freely. Many others have done so.

J. F. CARLEY

579 Ruby Rd
Livermore, CA 94550

You're right, I could have. Most contracts for books stipulate that in case of a lawsuit resulting from the writer's book, the writer is responsible, not the publisher. But most publishers also stipulate that they will stand with the writer if they feel that the lawsuit is unwarranted. In the case of the CBC, the argument was that CBC felt a lawsuit would have been justified. That's no way to form a strong writer-publisher team.

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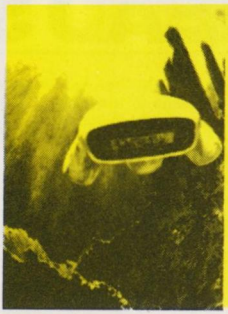

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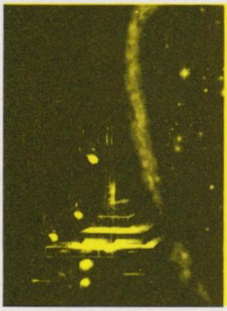

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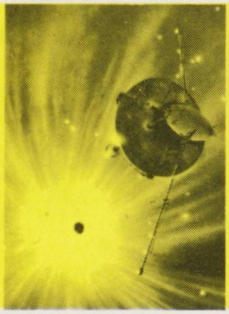

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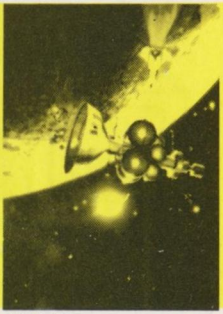

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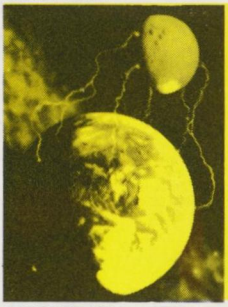

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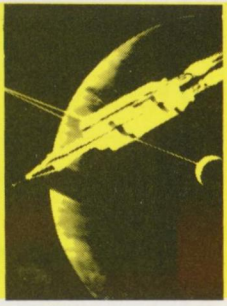

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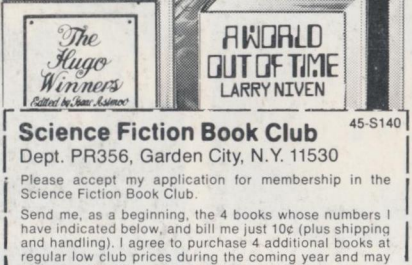

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