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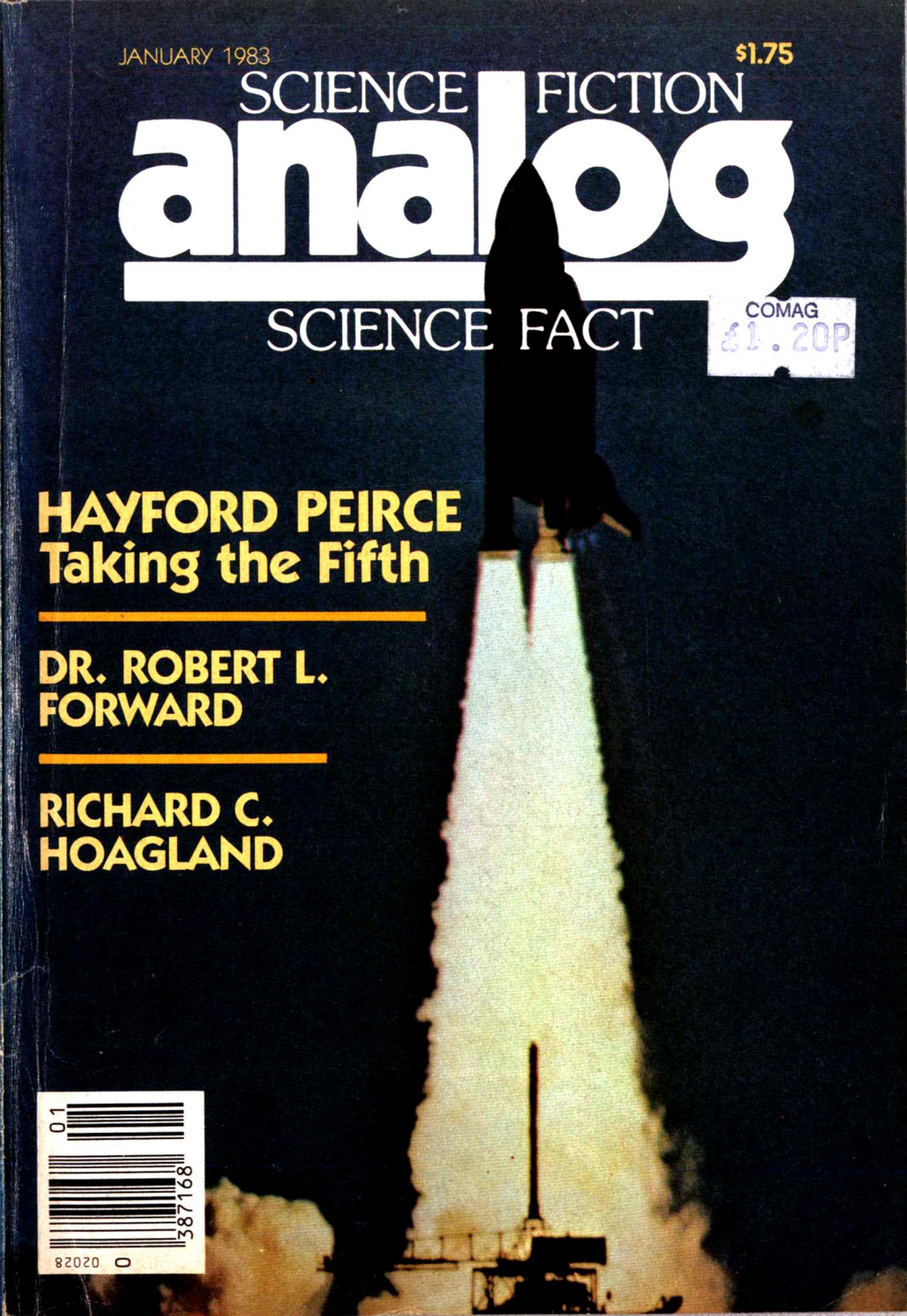

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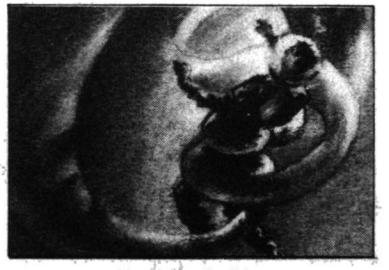

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Editorial

THOSE NASTY OL' CENSORS

by Stanley Schmidt

Some month I may devote a whole editorial to the recent spate of book burnings and bannings which has swept the country, but today let me take a different tack. Much as I deplore these and all similar efforts of the arrogantly self-righteous and insecure to control what others read and view, I must confess that I have something in common with the legions of censors. So does every other editor, teacher, parent, and program director. It's not always our fault, mind you, but it is true—and inevitable.

Every month I select for publication approximately 170 pages of material — out of approximately 100 times that much which is offered to me. Every teacher (or curriculum committee) selects certain topics to include and others to omit from courses. I choose those things I think you will be most interested in reading; the teacher selects some mix of things which his students want and things which he thinks they need. We all have to make such choices because of the sheer volume of available material and limitations of available time and space.

But because we must select what we put in front of audiences, most of us are periodically accused of systematically suppressing something that somebody else wants us to present. Writers of insipid stories assume I reject their stories because I'm afraid to let their ideas loose on the world. (Actually, in many cases, I've seen those ideas a dozen times a week for four years and I'm just bored with them.) Students suspect teachers of pushing a Party Line and not tolerating original thought. (Never mind that some original thoughts, like 2 + 2 = 6.3, really aren't worth much.) I'm occasionally informed (by people who don't know me) how I'm a tool of the

Establishment which is dedicated to suppressing ideas which might rock the societal boat.

I could point out that full-fledged suppression takes a little more than one editor, or even several editors, refusing to print something. Barring governmental edicts, of which we are relatively free in this country, if I turn down your masterpiece, some other editor can print it—if you can find one who wants to. Failing that (which is quite likely, since the total volume of matter professionally printed is still far smaller than the amount written), you can print it yourself. "But that's an empty promise," you may retort. "The press is only free for the man who owns one." There's some truth in that, so I'll concede the point without dwelling on the suggestion that if your story or theory is *really* important to you, you might find a way to save enough pennies to buy a small press, and if your ideas really have enough merit (which, in science, means evidence) somebody with influence may eventually notice them. That is, after all, a difficult approach at best, and a proponent of an unfashionable theory may quite reasonably object to being confronted with hurdles which are not placed in the path of the guy with nice "safe" ideas. It could be argued that those hurdles serve a useful function by requiring new theories to demonstrate considerable strength before they're accepted. But I'll agree that there should be places where unorthodox ideas of potential merit can be aired. After all, the scientific establishment needs opposition, too, to keep it on its toes.

Analog is such a place, despite the claim of the reader who thinks he detects "a steady drift to the scientific right" since John Campbell's death. This reader claims it has been years since scientific orthodoxy has been questioned here; I can only assume he slept through our discussions of parapsychology, irreproducible phenomena, faster-than-light travel, neurophones, etc. He seems to think Campbell, despite his own evolutionary leanings, would have encouraged the current crop of anti-evolutionists. What John would have done is intrinsically irrelevant now, of course, but I suspect he *would* have encouraged attacks on conventional evolutionary theory — *if* they were backed by evidence and sound reasoning.

So do I—but I haven't heard many that were. Neither John nor I ever had much interest in pushing theories for which we couldn't make a supportable case. (John once remarked that the universe does not recognize your right to your own opinion, unless your opinion is in accord with the facts.)

Now that I have annoyed some of you by mentioning evolution, I'd better pause to promise that I'll return shortly to that currently fashionable bone of contention. First, let me dwell a little longer on our alleged suppression of unorthodox theories. I receive enough of them in a year to more than fill all our issues, but I couldn't do that even if I wanted to. Our readers are paying mostly for *stories*; we average one fact article per issue, and invariably get complaints on the rare occasions when we have more. A fact article I buy may be speculative (indeed, I wish more of them were), but it *must* be one of the

dozen or so I think our readers will find most interesting and challenging—and it must have some substance. If it challenges accepted theory, it must present a strong enough case to present a *real* challenge, backed by evidence that raises real doubts. Unorthodoxy alone is not enough to merit publication at our expense. You can publish anything you like, on your own, but if you want us to do it with our time and money, you must convince me it's worthwhile. You won't do that with a paper riddled with obvious and elementary errors of evidence, logic, or mathematics. Many of the papers I reject are just that—and would be just as quickly rejected no matter how orthodox their content.

Let's take a closer look at that evolution-creation brouhaha and our role in it. Please note: My intent is *not* to prove one theory or the other. Some people seem to miss that point; they look at an editorial about credulous acceptance of "creation science" and complain that I didn't present hard scientific evidence for evolution. Well, why should I? Evolution *per se* was not my subject, and the evidence has been presented many times elsewhere. Anyone who has examined those presentations and remained unconvinced is unlikely to be swayed by one more repetition from me—and I don't care if he is, anyway. I'm not trying to sell a set of beliefs—but I would like to see whatever one believes determined by evidence rather than by what one *wants* to believe. (Ironic sidelight: One reader complaining about my failure to present evidence for evolution concludes with a dogmatic statement that evolution is a fraud. His hard evidence for that claim seems to have been suppressed in the mail.)

One of the most articulate letters I received was from a person with both scientific training and creationist leanings, whose main concern in the whole affair is that the scientific establishment has enthroned evolution in its present form and suppresses all opposition by such means as ridicule, refusal to listen or publish, and denying "heretical" students access to advanced education and scientific employment. He compares the situation to the problems of Copernicus and Pasteur in getting their "unscientific" views accepted. His concerns are valid ones, to the extent that his allegations and comparisons are valid, and he raises several points which cannot be dismissed glibly. Yet even he seems to miss certain crucial distinctions, such as the difference between a theory and a hypothesis, and the fact that Copernicus and Pasteur eventually prevailed *because they had evidence and coherent arguments that wouldn't go away*. If creationists can do that, they will prevail, too—but they have not done it so far, at least in my presence.

They *have* pointed out some questions that the present form of evolutionary theory is not yet prepared to answer in detail—but none of them requires the abandonment of the basic concept, and those working in evolutionary theory are at least as conscious of them as anyone else. Some critics seem incapable of recognizing any middle ground between totally right and totally wrong—yet all theories have gone through successive refinements. One reader says that if he measured a mass with an analytical bal-

ance and got successive values of 0.5005 gm, 1.0005 gm, and 1.9886 gm, he would not dignify his technique by calling it a "search for truth." Neither would I—but only because the analytical balance is an old, highly refined instrument which I know can do much better when it's working right and used properly. I could build a balance with Tinkertoys which works on the same principle but is orders of magnitude less accurate and less precise. The *principle* is still right. In young fields of research, the best professional data is not uncommonly even worse than in my correspondent's example—but that means those fields need to be refined, not abandoned.

Evolution appears to be in a similar position. Sure, there are lots of details to be resolved—but I know of far more evidence for the basic nature of the process than for creationism. This is not to say absolutely that nothing that could be called creation has ever occurred (I have bought and anthologized stories in which it did), but none of the problems facing evolutionists seems to require scrapping the whole concept and substituting one with even skimpier evidence. I realize that some anti-evolutionists refuse to recognize any evidence for evolution, because it's of a somewhat indirect nature and requires some inferential reasoning to get from the observations to the conclusion. But if you buy that kind of argument, you've already given up on science. If you're going to reject evolution because you can't sit and watch a paramecium evolve into a paleontologist, you have no excuse to accept atoms or stellar evolution, either.

Yes, there are gaps in the evolutionary record and surprises in the time scale. One of my letter writers scoffs at the idea that missing intermediate forms exist but haven't been found—after all, we've had a hundred years to look for them. Well, let's put that in per-

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spective. Taking a hundred years to examine all that has happened in 4.5 billion years is like trying to examine the world's events of the last year in less than a second—except that there has been much more time for evidence to be hidden or destroyed.

Yes, questions of gaps and time scale and details of mechanism need to be answered. They're being worked on. So far there doesn't seem to be any compelling need to bring miraculous creation into the picture. If there eventually does turn out to be such a need, we'll do it—but that won't really *answer* the question of ultimate origins, just remove it an additional step from ourselves. (Wouldn't it be interesting if somebody found hard scientific evidence that God exists—and that He is a product of evolution?)

All this is a digression (though a relevant one) from my main point concerning the alleged suppression of ideas ("creation science" is only an example) by the Powers That Be. One of my correspondents, favoring the inclusion of creationism in curricula, mentions that when he was in school two theories about a point of chemistry were taught: one which had become widely accepted, and one which had fallen into relative disfavor but had not yet been altogether abandoned. The point is that the evidence did not yet overwhelmingly favor one view (and besides, the scientific establishment has inertia, too). There are contemporary analogs: for example, steady-state cosmology is still taught as a possible alternative to "Big Bang" models, though it has relatively few adherents at the moment—but it tends to receive proportionately little time in class. Students should know that it's there, since the controversy is still somewhat alive; but until it develops more promise than it shows now, the students' time is better spent preferentially on the models which currently seem more productive of useful results. "Creation science," from here, looks several shades less worthy than steady-state cosmology—by all means mention it, but don't waste a lot of class time on it, and don't kid the kids that, "One theory's as good as another."

Which brings us back to the crux of the problem: teachers and editors *have* to be censors, to some extent, whether they like it or not. They censor, not in the sense of, "No one may talk about this because it's evil," but rather, "I won't spend class hours or magazine pages on this, because I only have so many and there are other things that I *must* get in." One reader asks why we're "afraid" of creationism being taught alongside evolution. Another comments on the uproar that followed the passage of a law in Arkansas requiring that "all scientific evidence pertaining to origins must be made available to students in the state schools." As I recall, that's not quite what the Arkansas law said—and even if it is, it can't be done. There simply isn't *time*. Few courses even manage to cover everything in the textbook. Forcing them to squeeze in every idea ever proposed, while shirking value judgments, would just waste valuable time already in too short supply for other purposes.

A teacher or editor *has* to make judgments of what things are worth spending

class time or text pages on. Which ones will be most valuable to his students or readers? A good teacher, in particular, will concurrently be teaching his students to make their own, *rational* value judgments—*not* encouraging them to look at all proposed alternatives, no matter how contradictory, and say with a shrug that all are equally valid. The universe says they aren't. Only one of them (at best) is right, and the teacher is perfectly justified in pointing out which one looks like the best candidate—and why. The "why," of course, may well involve mentioning alternatives which are serious contenders or have historical importance, and describing evidence for and against them. But in the case of weak contenders, this is not likely to involve "equal time," or anything like it. And it *will* involve identifying them as weak contenders, not pretending that they're as good as any other.

It's an awesome responsibility, if you think about it. It would be nice if we *could* always take time for a leisurely exploration of all the ideas human thought has produced, but it's been a long time since that was possible. There is already too much, and it's growing and changing faster than ever. As a teacher myself, I often felt frustrated at having to skip lightly over subtleties and controversies, and occasionally a little afraid that something I skipped might eventually turn out to be more important than something I did meticulously. There *is* a good chance that a teacher's best view of the truth will in time prove to be flawed—perhaps badly. Nonetheless, with the finite time available, he has little recourse but to give it his best shot—and try to make the students understand that that's all he's doing.

Given that he *must* be selective in what he teaches, there are two ways a teacher can justify to his own conscience what he's doing. One is to decide in advance what he's going to teach and brainwash himself into believing it, regardless of what the evidence says; maybe he can even find a few bits of carefully chosen evidence which, in isolation, can be arranged so they appear to support the stand he's committed to. The other way is to keep as up to date as possible on the latest evidence, and teach what can be concluded from that—along with as much of the evidence itself as he has time for, *and the skills for evaluating evidence*.

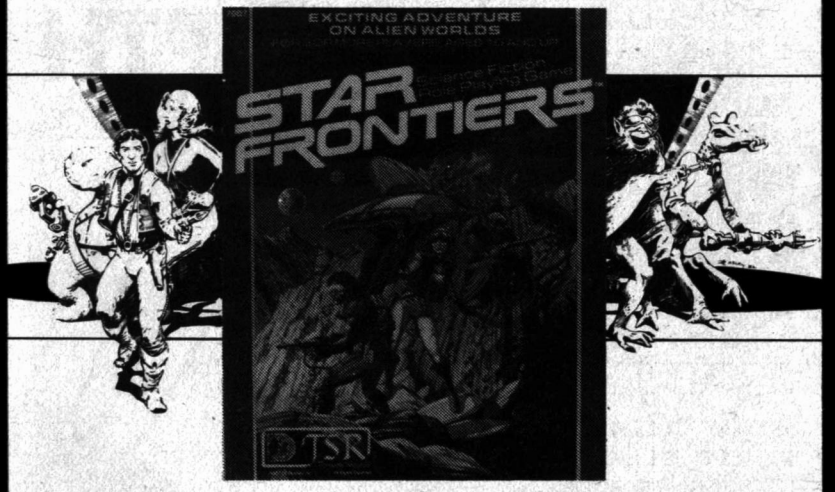
The latter, I think, is the approach we need more of. The former, unfortunately, is the one too often chosen. It is, after all, much easier. ■

•Economist: A man who tells you what to do with the money you would not have if you had followed his proposals in the first place.

•Policy: A common substitute for good judgment.

The Management Dictionary, Kelvin Throop III

Defend The Galaxy...



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TAKING THE FIFTH

Hayford Peirce

December 18, 1985

The first billboard appeared simultaneously throughout 16,348 American cities and towns. A small child lies tumbled in a trash-strewn gutter. Her eyes protrude grotesquely from a contorted face and blood gushes from her open mouth. A Santa Claus doll, ripped in two, frames one of her bare legs. A little white shoe, torn from her foot, seems to float in the thickening pool of blood. On most of the signs the little girl is white; on some black; on others brown. But on all, the blood is a brilliant red.

ONLY SIX MORE SHOPPING DAYS TO CHRISTMAS, reads the caption, BUT 482 OF US WON'T MAKE IT. WE WILL BE MURDERED. HELP PUT THE MURDERERS IN PRISON. GIVE A CHRISTMAS DOLLAR TO *CLEAN* AND HELP CLEAN UP OUR STREETS. *C*oalition of *L*aw *E*nforcement *AgeN*ts

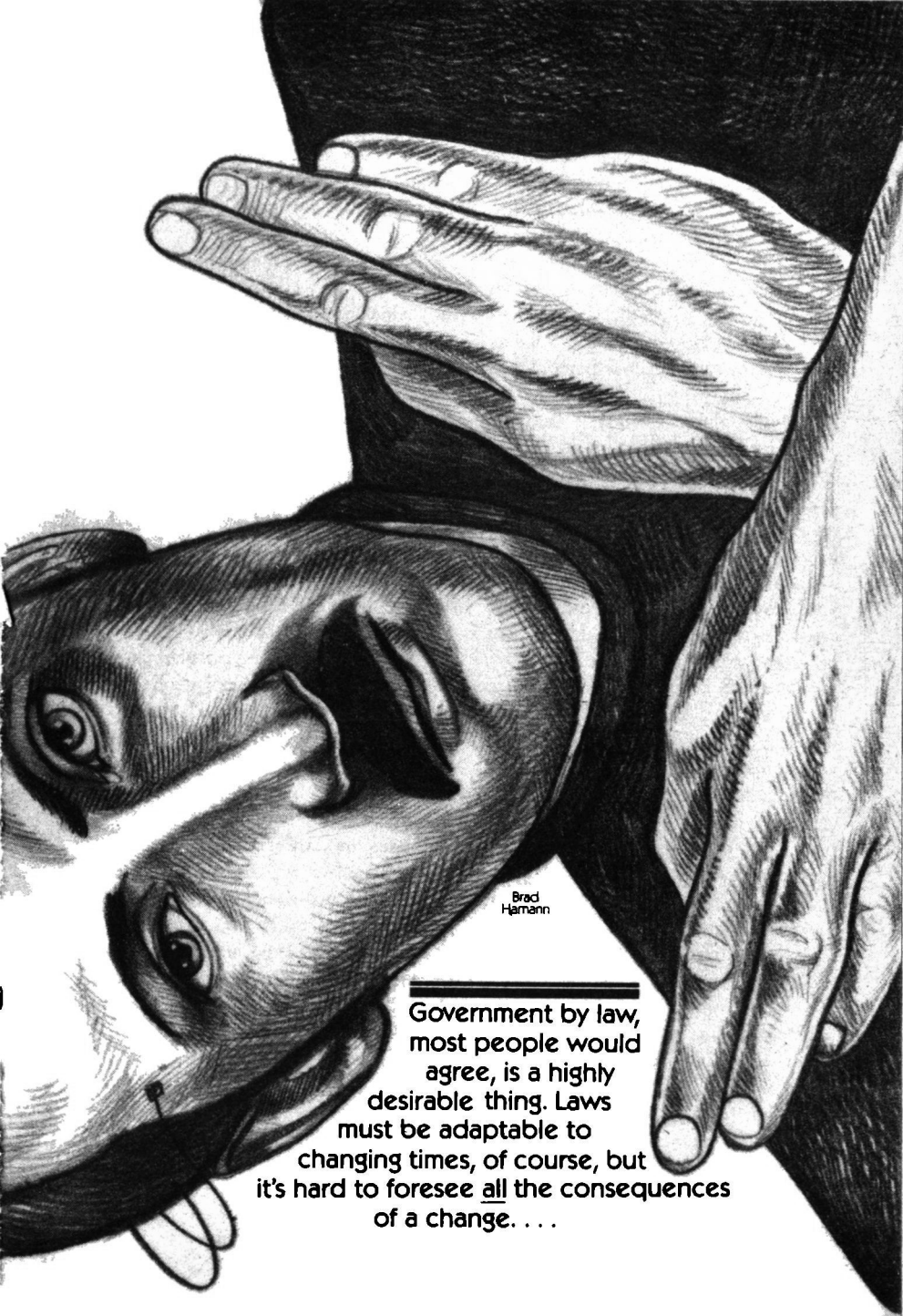
In the next seven days 47,819 outraged phone calls were counted at newspaper, radio, and television switchboards, and in various police stations. A number of newspapers wrote indignant editorials.

But no policemen pulled down any billboard.

And $27,845,264, mostly in one-dollar bills, was received by CLEAN.

January 14, 1986

"Lemme get this straight," said the prisoner, "you guys'll pay me a million bucks, *one million bucks*, and all I gotta do is pass this here lie detector test or truth serum or whatever it is. Right?" His jaw thrust forward belligerently, he glared balefully about him at the four-



Government by law, most people would agree, is a highly desirable thing. Laws must be adaptable to changing times, of course, but it's hard to foresee all the consequences of a change. . . .

teen people clustered around the dentist chair in which he lay. The small crowd—George Bowman, American chief of operations of Veritas Incorporated; Veritas's lawyer; three stenographers; three audio-visual technicians; two medical technicians; a doctor; the prisoner's lawyer; the Warden and *his* lawyer—nearly filled the second-story medical lab in the west wing of Rahway Prison. They stared back with unfeigned interest.

"Al*most* right, Frankie," said the prisoner's lawyer, a red-nosed but urbanely turned-out gentlemen named Stanley M. Kentfield, who reputedly represented the Mob. "What you've got to do is is simply repeat for these ladies and gentlemen the same testimony that you gave at your trial. And that of course won't be difficult, since it *was* the truth, *wasn't it*, Frankie?"

Was there a hint of menace in the lawyer's voice, George Bowman wondered, as he watched his team of technicians install and test to their satisfaction the three tape recorders and four video cameras which would record the session from a variety of angles. Yes, a large dose of menace even, he decided. "Exactly," confirmed Bowman. "If you repeat substantially the same story you told at your trial, my company, Veritas Incorporated, will place in an escrow account the sum of one million dollars, to be paid to you upon your release from prison in, I believe, another twenty-seven months. Minus, of course, the 25%, um, honorarium paid in advance to your, er, counselor, Mr., er, Kentfield here."

Counselor Kentfield nodded vigorously in unabashed approbation. "And if you *don't* tell the same story, Frankie," he admonished, wagging a playful finger, "then *you* don't get your million dollars, and *I* don't get my fee, and we don't want that to happen, *do* we, Frankie?"

Electrodes were being placed about the prisoner, and a drip bottle was carefully attached to the chair. "And, of course," intervened J. Wilson Denslowe, attorney for Veritas, "if by some chance you *do* tell another story, for instance a story somewhat more akin to what the prosecution alleged to be the course of events which eventually led to your, er, incarceration here, this cannot be considered as evidence against you, and will have no bearing upon your sentence. In other words, nothing you say here today can be used against you, or to bring you to trial again."

"Sure, sure," said the prisoner jauntily. "I know all about double jeopardy. But the truth's the truth, ain't it? How could I tell it any different?" And he winked disarmingly at the comeliest of the stenographers.

"Indeed," muttered Denslowe, fingering his long chin dubiously. That the prisoner was serving merely a term for involuntary manslaughter instead of homicide one was, he felt, both an affront to common sense and a tribute to the venality of the New Jersey judiciary. "If today's session tends to substantially validate your testimony at your trial, we would all, of course, be morally obligated to do whatever we could do to obtain a new trial, or a free pardon from the governor."

"A pardon," snorted George Bowman, but softly, as he directed the introduction of the needle hanging from

the drip bottle into the prisoner's arm. That he could maintain a story which would eventually lead to a pardon and freedom was a course of events George Bowman considered as likely to transpire as the spirit of the late Joseph Stalin being invited to grace a seance of the Daughters of the American Revolution. And not only was it unlikely, Veritas Incorporated was betting one million dollars on its unlikelihood.

He nodded to the medical technician standing beside the drip bottle: the clamp was released, and a pint of Veritas' specially formulated recombinant RNA began to flow gradually into the prisoner. "Hey, it ain't gonna hurt, is it?" he cried suddenly, attempting to struggle forward.

"Not at all," soothed the company doctor, a man of supremely reassuring mien. "No pain at all. This is a process which has been tested thousands of times in other countries around the world, and there have never been any ill effects. Now just relax; just relax now. "

January 29, 1985

One year earlier, twelve conspirators had sat plotting.

"I think we have a chance," said the man chosen to be chairman, "a very good chance. But time is short and so is money. And money will be the key."

"As usual," said the treasurer dryly. "However, before we despair, let me give you the figures. For the 100th Congress, to be chosen on November 4th 1986, as usual all 435 seats will be up for election. In the Senate there will be one-third of the seats to be filled, or 34. And there will also be 29 gubernatorial races. That is a total of 498 races. We have already decided that party labels are meaningless on this issue, and that we shall present candidates for both the Republican and Democratic slates in all races, that is, 996 candidates. Plus, of course, as many candidates as we can field for the several thousand races in the state legislatures."

"We know all that, but how does it work out in terms of money?"

"It could be better; in fact, it *must* be better. According to last month's figures, there were 478,923 law enforcement officials in all branches of city, county, and state organizations. This excludes all civilian employees and federal marshalls, FBI, narcs, Secret Service, and others of that nature. Now, assuming that each one of these 478,923 would contribute $10 per month, that would come to $4,789,230 per month, which sounds impressive enough, until you realize that divided by 996 candidates for the major offices it works out to only $4808 per candidate per month."

"We're assuming then that every candidate will have to take an unpaid leave of absence?"

"Our counsel is quite adamant on that point."

"Well, at least there's more than enough there for monthly living expenses for each candidate," said the chairman.

"Agreed," said the political advisor. "A 'loan' of $2000 per month to each candidate ought to be sufficient to make up for any lost salaries, especially since you don't pay taxes on loans. But you'll note that that leaves only about $2800 per candidate per month, not enough to mount any sort of political campaign,

not even for the dinkiest primaries. Now, once we've got candidates chosen in the primaries, and running on the regular Republican and Democratic tickets, most of the fund-raising can then be left to the traditional party sources. But it's getting a thousand unknown cops nominated in the first place that's going to take the dough."

"I think," decided the chairman, "that we ought to be able to bump the average contribution up to $20 or $30 per month. Which would give us at least $10 million per month from the various law enforcement personnel, and which, if you subtract $2000 per month for living expenses, would leave about $8000 per candidate per month for campaigning, right? That would get us started, particularly for the congressional races, which cost only a fraction of most senatorial and gubernatorial races these days."

"Right. I suggest that we immediately earmark the first million we bring in to hire the best national firm of political fund-raisers we can find, and the next million to hire the best campaign managers there are, both local and national. Hopefully we will then be able to generate enough additional money, both from public fund-raising and from any other sources we can come up with."

"That should be a cinch," said one of the plotters. "Offhand I can think of half-a-dozen 'other' sources. I'm surprised none of you has mentioned 'em yet."

"Like what?"

He smiled. "First I think we better check this room out for bugs. ."

* *

January 14, 1986

As he watched the level in the bottle begin to sink, the prisoner felt no sense of tension at all. His heart ticked along at a steady 61 beats per minute, the palms of his hands were desert-dry, and his stomach was unaffected by butterflies. What a deal, he was thinking. Out of here in maybe two years at the worse, with three-quarters of a million bucks waiting for him in the bank.

The possibility that he would not be able to beat the test had never occurred to him. Years ago as a teenager he had been arrested for attempted shoplifting. So convincing were his denials that a standard lie-detector test of the time had been administered to him. Somewhat to his own surprise, he had passed easily and had been released with profuse if insincere apologies. Working later as a syndicate strongarm and extortionist had occasioned a variety of arrests on charges ranging up to great bodily harm and attempted murder. Confident now in his ability to beat the polygraph, he had demanded and passed three separate tests.

A business associate with whom he once shared cell space explained it to him: "The only way a detector works is if you're scared. If ya mind knows you're guilty it tells ya body and when they start askin' questions ya body knows ya mouth's gonna lie, and it starts sweating and your heart starts beating faster and like that. And that's how come they know when a guy's lying."

"So how come it don't work with me, then?"

Frankie's cellmate shrugged. He was

6-foot-5 and muscled like a water buffalo. He always said exactly what he thought. "Because there is some people what don't know they is guilty because they don't see anything wrong with anything they do, even if it is carving the eyeballs out of little girls. To a guy like that, telling a lie means no more than taking a leak."

"No kidding?"

"No kidding. A lie detector can never get them. They is what we call psychopaths."

"Psycho

"Paths. *You* are a psychopath, Frankie."

If the news bothered Frankie Spurway, he never showed it, even when his acquaintances began to call him "Cy." The fact that a new process was being used in Europe—rumor said that it had been developed by the CIA or the KGB and was being marketed through one of their fronts—was of no interest to him. Until now.

One instant Frankie Spurway was whistling noiselessly between his teeth, already attending his getting-out celebration. The next instant he was up at ceiling level, floating motionless in a corner of the room. Below him he saw a crowd of people gathered around a dentist's chair. With a feeling of supreme detachment he saw what looked like himself strapped in the chair, under the scrutiny of the audio-visual recorders, the stenographers, and lawyers. He registered dispassionately the fact that, as seen from here, his breathing was steady, his fingers lightly flexed, his eyes open and focused on some point of rapture an infinite distance away, a

ghost of a knowing smile upon his lips. That he was simultaneously up here by the ceiling and his body down below was of no moment, it was simply the way things were.

A voice was asking his name.

"Frank Davis Spurway," he heard his mind reply at the same time that he saw his body's lips move. His body must be talking. But that was of no interest. Up here all was icy cool, pure detached intellect. Disdainfully he watched the activities below. Occasionally he seemed to see his mind frame an answer to a question, and his body's lips always seem to synchronize with whatever he was thinking. Somehow it was almost amusing.

"You are that prisoner, number 273-8285-22, at Rahway Prison, serving a three-to-five-year term of imprisonment for the involuntary manslaughter of your wife, Carole Hendley Spurway, on September 10, 1984?"

"Yes."

"Do you have any comment to make about your trial?"

Silence.

"You will note that he replies only to direct questions. Now then. At your trial you testified that you were attending the horseraces at Yonkers Racetrack on the evening of September 10th, at the time your wife was being shot, in spite of seven witnesses who testified to seeing you running from the house, a gun in your hand, a few moments before your wife was found dead. Is that correct?"

"Yes."

"Hmmm. Let me rephrase that. Is it correct that you testified that you were at Yonkers Racetrack?"

"Yes. That is correct."

"But was your testimony that you were at Yonkers Racetrack actually the truth?"

"No. It was not the truth."

"Where were you on the night of September 10, 1984, at the time your wife was killed?"

"I was at home, in the living room."

"I see. And what were you doing?"

"First I was watching the Monday Night Football game and drinking beer. Then I took a gun from the table beside the couch and I shot Carole. Then I left."

"And how many times did you shoot your wife?"

"I shot the gun four times, but one shot missed, so I only shot her three times."

"Why did you shoot her?"

"I was trying to watch the game. She tried to change the channel to the movies just when the 49ers were ready to score."

"The gun was never found. What did you do with it?"

"The next day I put it in a plastic bag and buried it in a field outside of Morristown."

"Why did you do that?"

"It was a brand-new gun. I thought I might need it again sometime."

The questions droned on, the figures down below shifting from time to time. Then suddenly—

George Bowman watched animation gradually return to the saturnine features of Frankie Spurway, a quickening to the feral brown eyes. He saw the prisoner's lips draw back as he ran over the events of the last hour.

Spurway stared in horror at his lawyer, Stanley M. Kentfield. "Hey," he implored almost inaudibly, "I didn't say anything, did I? I didn't say anything, did I? It was all a dream, wasn't it?" His voice rose to a scream. *"Wasn't it?"*

Stanley M. Kentfield turned his back.

February 2, 1986
Detective First Class Larry Taber, Republican Candidate:

"—and as you've just seen in this 100%-authenticated documentary, that gun *was* found the next day, dug up by New Jersey State Police in *exactly* the spot where the killer Frankie Spurway said he had buried it!"

Detective First Class Taber paused to gesture urbanely at his audience in the Odd Fellows Auditorium. "Now don't you think, ladies and gentlemen, that digging up that gun *proves* to the satisfaction of any *reasonable* man or woman that this Veritas process actually *works*, that's there's no way of fooling it, and that there's no reason on earth why the people of the United States shouldn't be able to use this process to defend themselves and their loved ones and their property against the brutal assaults of killers and rapists and murderers and thieves and liars and muggers and arsonists and all of the other animals that are loose on the streets today! Well, do you agree, ladies and gentlemen," he shouted, *"do you agree?"*

"Yes!" they roared back, "Yes!"

February 13, 1986
Captain Francis Xavier Rooney, Democratic Candidate:

"—and for a while the fancy profes-

sors across the river at places like Harvard were telling us, oh don't be worried because it looks like the crime rates are going up, oh don't be worried because the statistics say that this year there's a better-than-even chance that you or your wife or someone in your family will be killed or raped or attacked or robbed. Oh no, don't be worried, folks, things aren't always what they seem.

"No sir, the crime rates just *seem* to be going up, said the professors, because more and more people are *reporting* crimes that they didn't use to report, and more and more police departments are writing down the *reports* of these crimes, and more and more computers are having more and more *statistics* of crimes put *into* them, so that at the end of the year when some great big computer down there in Washington counts up all the crimes in the country and divides that total by the number of people, why every year the rate *looks* like it's going up and up, doesn't it? But oh no, don't you worry, my friends, it's only because the *computer* is getting smarter and smarter. No, don't worry, friends, not unless you're one of those statistics that guys like me have to carry off to the hospital or the morgue. "

February 26, 1986

Patrolwoman Patricia Mayfield, Republican Candidate:

"—did it *look* as if that man Spurway was being tortured while he was answering those questions? Did it *look* as if he was experiencing even the slightest discomfort? Did it *look* as if he was being given the third degree? Did it *look* like police officers was beating on him with rubber hoses and burning him with cigarettes and shooting him full of electricity like they do in Iran and Iraq and all those other foreign countries? Tell me, *did it look like that?*"

"No!" they roared back, "No!"

March 2, 1986

Patrolman Robert Fogelberg, Democratic Candidate:

"—they also said that rising crime was a simple matter of demographics, the rise in the birthrate after World War Two, the so-called Baby Boom that lasted for almost ten years. Young people, they said, are the ones who commit crimes. Once the birthrate comes down and there aren't as many young people as there used to be, why then, the crime rate will start coming down too!

"Well, that's good news, isn't it? Here we are in 1986 and we've got the lowest birthrate we've ever had in the history of the United States, and it's *been* the lowest in history for the past 'twenty years now, and we now have the greatest percentage of people over thirty years of age that we've ever had, and the lowest percentage of people under twenty years of age, and you want to know something, ladies and gentlemen?

"With all that good news, there's just one problem—the crime rate today is the highest it's ever been in the history of the United States! And it's still rising!

"And it's not just crimes committed by the young! Or in the cities! Or in the slums! It's everywhere! The rates are up in the cities and the suburbs and the villages and the countryside. It's up among the young and the old and the middle-aged. It's up among the blacks and the whites and the hispanics and the American Indians. It's up among the

farmers and the white-collar workers. And if there hadn't been a baby born at all within the last twenty years, it would *still* have been up!

"What do you say to *that?*"

There was a long silence while he carefully poured himself a glass of water and sipped it reflectively:

"Well," he went on, "one sociologist said last week, I've got the article right here if any of you want to read it, that the reason there were more robberies and more burglaries than ever before, was that more and more people now owned more things worth stealing!

"Well now! I guess you have to be a university Ph.D. to come up with an observation as useful as that one!

"Now, I've only got a diploma from high school, and another from a two-year junior college, but I'll tell you this: I don't think the American people want to be told that it's their own fault the crime rate is going up because they own too many nice things!"

March 13, 1986

"Now that's kinda funny," said Patrolman Denio Sanchez, his lips pursing in amazement. "You don't *look* like the kinda guy who doesn't want to contribute a thousand bucks to CLEAN."

The rumble of Lexington Avenue traffic pushing its way through Harlem was barely audible in the large office discreetly hidden away in the rear of Smitty's Step In Bar & Grill. "Are you some kind of a nut, officer?" inquired Abdul Muhammad, scowling up from his desk. "You think you can shake *me* down for a thousand bucks? *Me?* Ya gotta be joking. I been paying off to your precinct captain every week now for twenty years. So go check with your captain, sonny, before you try putting the arm on Abdul Muhammad." He turned away impatiently, for late afternoon is a busy time in the numbers racket.

"You know," said Patrolman Sanchez regretfully, "I think you're making a big mistake, Mr. Muhammad, but if *you* think I should check with the captain, I guess that's what I better do. I'll let you know his answer. Be seein' ya, now."

"Up yours," muttered Mr. Muhammad absently as he pushed buttons on his desktop computer.

Patrolman Sanchez returned later that evening to deliver the captain's message, accompanied this time by two more patrolmen and three plainclothesmen, a warrant in his hand for the arrest of one Sampson P. Bock *aka* Abdul Muhammad. The two customers of Smitty's Step In Bar & Grill watched them push their way through the smoky gloom to disappear somewhere in the rear. A moment later a fusillade of shots overwhelmed even the din of the bar's 27-inch television set.

The six officers later testified that, upon presenting the arrest warrant to the three men present in the rear office, the man who was the alleged ringleader of the apparently recently opened numbers operation suddenly and without provocation drew a pistol and commenced firing, scattering four shots at random, fortunately without hitting any of the officers.

Mr. Muhammad and his two associates, who had by now also joined in the shooting, were not so lucky, however. Mr. Muhammad and one of the others

died of police bullets before reaching the hospital. The third man, one Jimmy Lickert, survived, but only in a manner of speaking, in a vegetable-like coma. Three pistols were clearly established by paraffin and ballistics tests to have been fired by the hands of Mr. Muhammad and his misguided friends.

Mr. Muhammad's successor in the rear office clearly found CLEAN to be more to his taste, for he was happy to contribute $5,000 to it.

March 16, 1986

Lieutenant Hewitt L. Stevens, Republican Candidate:

"—know as well as I do what the situation is today. *You're* the people that don't dare to leave your homes at nighttime. *You're* the people that don't dare to walk the streets of our cities. *You're* the people that are shot and killed and stabbed and wounded and tortured and maimed for life and robbed of all your savings and mugged for a nickel and killed for a dime! *You're* the people that pay!

"Well, I'll tell you, ladies and gentlemen, if you vote for me tomorrow and choose me to represent the great Republican Party and then elect me to go on to Washington this November, why I'll tell you something"—his voice sank to a confidential whisper—"these things are going to *change*. And why are they going to change? They're going to change because you, the people, *want* them to change, and as your duly elected senator, I'm going to see that they *do* change!"

March 21, 1986

Captain Lucille Hosmer, Democratic Candidate:

"The fact that a sacred cow *is* a sacred cow, and has always *been* a sacred cow since time immemorial, doesn't necessarily mean that that poor old cow ever *should* have been called sacred in the first place!

"The fact is, my friends, a lot of people standing right here in this shopping mall will probably tell you without a moment's hesitation that those crazy Hindus over there in India are just plain crazy the way they worship those sacred cows of theirs that wander around eating their crops and messing their streets and generally being just a great big pain in the neck.

"Well, let me tell you, friends and neighbors, we may not be Hindus, but we've got some almighty sacred cows of our own right here in God's own country, the You-nited States of America, and we've got some sacred cows of our own right here in the 4th Congressional District of the great State of Indiana, and I'm gonna tell you this: of all the almighty sacred cows we've got wandering around eating our crops and messing our streets, the biggest, and fattest, and most wasteful sacred cow of all is the 5th Amendment of the Constitution of the United States!"

AMENDMENT V

No person shall be held to answer for a capital, or otherwise infamous crime, unless on a presentment or indictment of a Grand Jury, except in cases arising in the land or naval forces, or in the militia, when in actual service in time of war or public danger; nor shall any person be subject for the same offense

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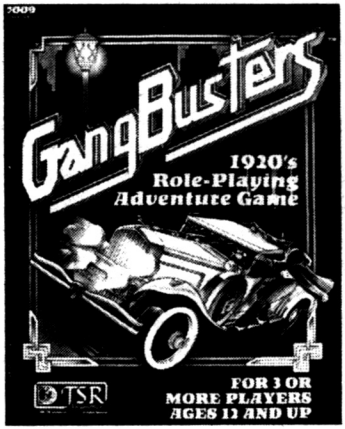

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to be twice put in jeopardy of life or limb; nor shall be compelled in any criminal case to be a witness against himself, nor be deprived of life, liberty, or property without due process of law; nor shall private property be taken for public use without just compensation.

March 31, 1986

Sergeant William Molinaro, Republican Candidate:

"—now some of you may be saying that it seems like there's an awful lot of policemen and policewomen and detectives and sheriffs—and even sergeants—all running for the United States Congress and the United States Senate, and all of them making the same speech like we all had the same speechwriter, and how come all this is happening at once?

"Well, it's happening because there's an awful lot of guys like me, the cops on the beat, and the plainclothesmen down at the station house, and I'll tell you, we're just almighty sick to death and fed up to *here* with picking up mutilated bodies and wiping up the blood of innocent people and being shot at by punks and knifed by dopies and having to tell wives and mothers their husbands and children aren't coming home tonight because they got shot up by some hophead holding up the corner grocery store!

"*That's* why I'm running for office, and that's why all of my friends in law enforcement are running for office, and that's why you're gonna nominate me next week on the great Republican platform, and that's why you're gonna elect me to the United States Senate come this November.

"And if by some chance you *don't* choose me to represent you next week, then I ask all of you, I'll even beg all of you, that come November you'll go out and cast your vote for Patrolman Robert Fogelberg, even though he's a Democrat, because on an issue like this one, party labels don't mean a damn!"

April 8, 1986

Patrolwoman Lucinda Gonzales, Democratic Candidate:

"—we *know* that rehabilitation doesn't work, we *know* that suspended sentences don't work, we *know* that there's only one solution that *does* work.

"And what's that solution? Why, it's the simplest one in the world. You catch a criminal and you put him in jail and you keep him there for a fixed amount of time, and I guarantee you, friends, I guarantee you one thousand *percent*, that *while that criminal is in jail he will not commit one single solitary crime!*

"In fact, in all of recorded history throughout the entire world, there has never been one case, *not one single case*, of any criminal locked up in jail robbing or mugging or killing or terrorizing any innocent people outside of that jail! Not one! I tell you, not one!

"And if we caught *all* the criminals who committed *all* the crimes, and locked them *all* up at the same time, you know what we'd have, friends? *We wouldn't have any . crime . at all!*"

April 16, 1986

"Listen to this now, will ya?" said Jack Belmont, president of Ideas Unlimited, speaking to his executive commit-

tee. "A letter from a little old lady, it's to CLEAN, dig?"

My husband Brian was the most wonderful man I will ever know, and we shared thirty-two years of perfect happiness together until that awful night two years ago when we came out of the movies at the Bijou Theatre and were attacked right there on the main street of town by three teenage thugs. My husband was in frail health and unable to resist, but he was brutally beaten until he fell to the ground, and one of the thugs kicked him in the head with his army boots and smashed his head in. My own arm was broken and I lost the sight in one eye from when they broke my glasses and a piece of glass stabbed my eye, and I now also suffer permanent impairment in the other.

One of them was caught, but he was only sixteen and denied everything and refused to identify the two others. By the time he came to trial the vision remaining in my one eye was so bad that his lawyer was able to make a fool of me in the courtroom when I tried to identify him. The trial was held in juvenile court and the judge did everything he could to help the defense. He finally let my assailant free, saying it was because of lack of evidence, and anyway he came from a broken home.

Until that time I had always believed in American justice, just like they wrote about in the books at school, but now I tried to tell the truth about my case and my poor husband's murder to the newspapers. One of them printed my story and so I was sued for libel by the animal who had killed my husband and blinded me. I have had to use the last of my savings to hire lawyers to defend myself, and last month I had to sell our little home that we saved for all our lives and move to a nursing home, where I will have to finish out my days, such as they are.

I went to see the lawyers at the American Civil Liberties Union to ask if they could help me out with the libel case like they do with all those criminals you always hear about, but they said they didn't see any violation of my civil rights anywhere so they couldn't help me.

I don't have much money left, and I'll never be able to work again to make any more, but I've been hearing about your CLEAN campaign and your idea to get decent policemen elected to Congress so that we can use that new truth-serum process. I am enclosing a check for one hundred dollars if this will help you, I am sorry that it isn't more, but it is all that I can afford.

I pray to the good God on my knees every night that you will succeed and that you will be able to catch and put behind bars the vicious animals that are roaming the streets and ruining the lives of people like me. I know you can't give me back my wonderful husband Brian or even my vision, but I pray that you will be able to keep the same thing from happening to other innocent people.

May God bless you,

Mrs. Brian Kaufman

"Jesus," said the art director, Sandy Wilson, "that's a little raw, isn't it?"

"Scrapes a nerve, does it?" Jack Belmont put down the letter and chortled immoderately. "That's what CLEAN hired us for, isn't it, fans?"

"Jack, is that letter even *half* for real?"

"Wellll now, I would say on the

whole, ye sss. There *is* a Mrs. Brian Kaufman and—''

''Okay, okay, so spare us the gore. What do you want us to do?''

Mr. Belmont stared at his executive committee in frank dismay. ''What do I want you to *do?* I want that unsolicited letter to CLEAN, and a copy of that $100 check, to turn up in every magazine and newspaper in the motherloving You-nited States of America! I want to see it in 10 million fund-raising letters! I want that letter from that little old lady to raise $100 million for CLEAN and the American Way of Life! *That's what I want you to do!* Nitwit.''

April 22, 1986

Inspector Raymond Cooley, Republican Candidate:

''—everyone's been blaming it all on the courts. Well, I have to admit that at times when I've been discouraged I've been one of those cops that liked to sound off about permissiveness and knee-jerk liberals and wishy-washy courts that'd rather turn a multiple killer loose than lock him up, and I'm not gonna tell you tonight that everything I said, and that my colleagues said, and that a lot of *others* said of that nature, was completely wrong.

''What I *am* gonna say, though, is that the basic problem was, and still is, *catching* the criminals. Once the average crime has produced a suspect and that suspect has been arrested, the chances are actually pretty good that that guy arrested is gonna get his a—, er, himself hauled off to prison. The problem is, that for every 100 crimes reported, there's only about *15* arrests made.

''And in *my* opinion *that's* why nobody dares to leave his house anymore. Why should your average knucklehead bother to go to a nine-to-five job like any other working joe if he's got an 85% chance of knocking you on the head and taking your wallet, or breaking into your house and taking your stereo and maybe raping your 14-year-old daughter just because she happens to be there at the time, and getting away with it? They say crime doesn't pay. Well, by God, crime *does* pay! It pays very well.

''Now, if we could turn that figure around, if we could *arrest* someone for 85% of the crimes—not just 15%—and *convict* that person, and lock him up for a couple of years in the slammer, then I will bet you my future job as a United States Congressman for the 13th District of the great State of New York that not only are we going to get the criminals off the streets and into the jails, we're also gonna keep the average knucklehead I mentioned a moment ago from even *thinking* about knocking somebody on the head and taking his wallet! Because he knows that if he does, sooner or later, he is going to be caught, and *he . knows that . he will go to . jail! And so he will not commit that crime!* And if that doesn't beat so-called rehabilitation, my name isn't Raymond J. Cooley!''

May 2, 1986

''It seems to me,'' mused the chief of police of Hartford, Connecticut, ''speaking purely as a private citizen, of course, who has been fortunate enough in the course of his official duties to make friends with so many of you gentlemen of the insurance world, that

you gentlemen above all would be interested in supporting the movement that so many of my colleagues are currently engaged in."

"Why should we be?" asked the chief executive officer of Global Insurance. "It sounds to me like every other single-issue political movement in the last hundred years, from the Populists and Free Silver through the Right-to-Lifers and abortion. These things come and go, and a businessman is only asking for trouble by getting mixed up in controversial issues. And there can't be anything much more controversial than amending the 5th Amendment!"

Chief Rossmore shrugged. "If we weren't *allowed* to amend the Constitution, there wouldn't be a procedure specifying just exactly how to do it, now would there? Last time I looked at the Constitution when I was down Washington way it was just an old piece of paper. To the best of my knowledge, Charlton Heston was the last guy to come down from the mountains with laws engraved on stone tablets." There were a few chuckles among the twenty-seven executives gathered in the room.

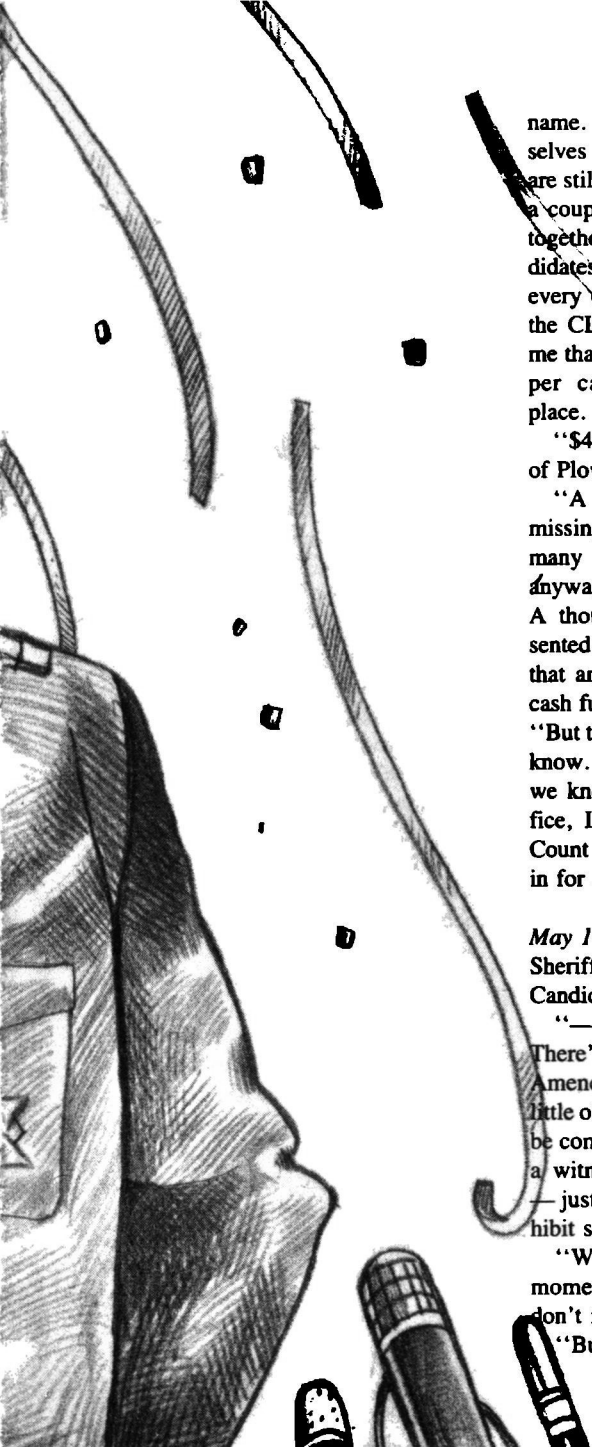
"It may be controversial, as you say," continued the chief, "but two things that aren't controversial are stockholders and the so-called bottom line." There was a rustle of interest. "Now, I didn't bother to phony up any figures for you gentlemen, since you have your own and they're certainly a lot more accurate than anything I can come up with.

"But let me ask you this: how many billions a year are your companies paying out for crime-related losses? Ten? Twenty? A hundred? Every car that's stolen, every bank that's held up, every truckload that's hijacked, every building burned down by an arsonist, every computer theft, every disability payment or medical bill or life insurance policy for assault or murder victims, every one of those costs you guys money." He fixed the chairman of Harvesters Life with an unblinking blue eye. "You're telling me that all *that* isn't your business? You *like* having to raise your premiums every year? You *like* hiring new field agents every year to investigate the claims? You *like* adding new staff and new computers every year to process the claims? Maybe I'm old-fashioned, but I'd think that maybe you gentlemen would like for once to *reduce* your costs, and your staffs, and your premiums, and your payouts.

"And if you did *that*," said the chief, grinning slyly at a corner of the ceiling, "you're telling me that you gentlemen couldn't find a way to maybe pass on some of those savings in reduced *costs*, along to your stockholders in the form of *increased dividends?*"

"How much?" said the president of Workers Beneficial, a gaunt Yankee notorious for his bluntness. "As you know very well, we, the insurance groups, have already contributed—to my certain knowledge—well over $15 million. None of us needs you to teach granny how to suck eggs, after all."

"Well now," said the chief, casting a reflective glance about the room, as if assessing the weight of their corporate wallets, "we started out a while ago with 996 major candidates running with CLEAN endorsement, every one of those candidates a plain old working cop just like me without a penny to his



name. A lot of them have got themselves nominated, but not all. But there are still the big California primaries and a couple of others coming up, and altogether we've still got about 400 candidates running. We're going to need every one of those 400 we can get, so the CLEAN people have suggested to me that an additional hundred thousand per candidate wouldn't be out of place. ."

"$40 million!" gasped the chairman of Plowmans Security instantly.

"A bagatelle," said the chief, dismissing it with an airy gesture. "How many insurance companies *are* there, anyway? Two hundred? Five hundred? A thousand? Why, the twenty represented right here in this room could find that amount salted away in their petty cash funds." To total silence he added: "But that's only to get started with, you know. Once the primaries are over and we know who's *really* running for office, I'll be back for the *real* money. Count on it, gentlemen: in for a penny, in for a pound."

May 14, 1986

Sheriff Billy Bob Patterson, Democratic Candidate:

"—like rational human beings, huh? There's just *one* little part of the 5th Amendment that needs repeal: it's that little ol' bit about 'nor shall (any person) be compelled in any criminal case to be a witness against himself.' That's all — just about a dozen words which prohibit self-incrimination.

"Well now, let's think on this for a moment. That sounds pretty noble, don't it, no self-incrimination?

"But let's ask ourselves this: where

do we draw the line on self-incrimination, anyhow? I think with a little reflection we're gonna see that that line is a pretty arbitrary one.

"Now, let's say some feller gits hisself shot holdin' up the Seven-Eleven down there on the corner come Saturday night 'cause the owner of that there Seven-Eleven just purely hates bein' held up and figgers to shoot first, so this feller, he staggers away dripping some rare blood type like Rh negative all over the sidewalk, and the next day we pick up some character with a bullet hole in his shoulder and a mug which just happens to be the same as the one that three witnesses says was holdin' up that little ol' Seven-Eleven, *and* he just happens to have that rare RH, negative blood type, you think that that there blood ain't gonna be introduced as evidence into court that this good ol' boy here has been down there holdin' up that Seven-Eleven of a Saturday night?

"Now, maybe this ol' boy's shyster lawyer is gonna yell and scream that this guy's blood is his own private blood and should never be introduced as evidence because it *is* self-incriminating, but that ain't gonna cut much ice with the court, 'cause if this guy who's on trial happened to have plain ol' O-type blood instead of the RH negative that's been squirted all over the floor of that there Seven-Eleven, you can bet your britches that that ol' shyster lawyer would be the first guy in court jumpin' around just purely *dying* to introduce that fact into evidence. Am I right?

"Okay. So now we got a guy's blood introduced as evidence. What else? Well, how about footprints, you say? Some character wearing size-14s comes

clomping through some wet cement on the sidewalk just outside that there Seven-Eleven he's fixin' to hold up. A guy's own feet! That's pretty self-incriminating, I'd say. But you know what? That court's gonna allow that footprint to be introduced as evidence.

"Okay, what else? What's that, mister? Did you say fingerprints? You did? Well, now. I guess all of us know about fingerprints, and I guess we all know that fingerprints are just about the most self-incriminatin' piece of evidence the Good Lord ever dreamed up. I mean, here's a man's own *fingers* gettin' him convicted and sent to prison for heaven's sake!

"And what does the Constitution say to *that?*

"Is there some place in the Constitution that says a guy's *fingers* can't be brought to trial?

"Or his *feet?*

"Or his *blood type?*

"Maybe there's some constitutional scholar out there who could tell the rest of us here where-all it says that?

"No? You say it *don't* say that *nowheres* in the Constitution?

"Well then, friends, if the Constitution of the United States says it's perfectly all right for a man's own fingers, and feet, and blood, to testify against him, well, maybe someone would tell a plain ol' country sheriff like me just why a man's own *mouth* can't testify against hisself!"

June 14, 1986

"Now that the last primaries are finally over, thank goodness, here is the situation," said the chairman.

"In 498 races we entered 996 candidates, a Republican and a Democrat in each.

"In 29 gubernatorial races we were successful with 10 Republicans and 8 Democrats. In three states we secured both the Republican *and* Democratic nominations, so we are assured of the governorships in those three states, and will be on the November ballot in 12 others.

"In the Senate, with 34 races, we have 23 Democrats nominated and for some reason only 15 Republicans. In seven states both candidates are ours, so we will have one senator from each of those states, plus a candidate from 24 others.

"We had hoped to do best in the House, and we did. In 435 races we succeeded in nominating 491 candidates, 248 Democrats and 243 Republicans. In 142 Districts we got both parties' nominations, ensuring us of 142 congressmen this fall, and leaving us with 106 Democrats and 101 Republicans in another 207 congressional districts.

"Let me remind you that two-thirds of 435 is 290. We already have 142, so we need another 148. It's very possible: we have 207 remaining candidates to elect 148.

"But we're going to have to work for it."

"And we're going to need money," added the treasurer.

"Get it."

June 29, 1986

Patrolman George Tasso, Republican Candidate:

"We all know a confession to a crime is a perfectly valid piece of evidence,

GIVE YOUR FRIENDS THE BEST OF ALL POSSIBLE WORLDS

GIVE

SCIENCE FICTION

analog

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just as long as it's been obtained properly, with the proper safeguards to protect the accused's rights, and I for one want to tell you that that's the way I think it *should* be. A suspect's rights *should* be protected. He shouldn't be beaten up, or third-degreed, or tortured, or punched in the kidneys, or grilled three days straight without being allowed to sleep, or any of those other things that sometimes I guess we useta hear about. And if he *does* want to confess, then he shouldn't be allowed to confess until he's been read his rights, and, if he wants to, to have his lawyer present. That's the American system, and I'm telling you that it's been the best system in the world for the last two hundred years.

"*But*, and I say but, if we had a perfectly painless, perfectly foolproof, perfectly infallible, 100%-guaranteed truth serum that would always, not sometimes, but *always*, allow the proper officials to question a suspect and determine his guilt or innocence, then why shouldn't a confession made under those circumstances be introduced as evidence?

"That's the question I, and all the rest of my brother officers, are gonna be asking the voters to answer for us in a couple of months come election day. And if enough of you answer the way we think you're gonna answer, there's gonna be enough of us in the 100th Congress to get right to the first order of business when Congress convenes on January 3rd of next year.

"And the first order of business, I guess I don't have to tell you, is gonna be the 29th Amendment to the Constitution of the United States! An amendment that will permit the use, with all the proper safeguards voted by each state and the Congress of the United States, of the Veritas process of obtaining confessions!"

July 9, 1986

Sergeant Oliver Gilman, Democratic Candidate:

"—and all the lawyers that work for the Mafia are gonna be out of business, and a lot of 'em in jail besides, because the Mafia *itself 's* gonna be out of business, so we know why *they're* moaning and groaning about human rights and civil rights and the Holy Constitution and the Sacred 5th.

"Now, I'm assuming that none of you ladies and gentlemen are Mafia mouthpieces, this is a small town and all, with a nice clean reputation, and anyway, you all look just like plain hard-working trial lawyers, just the way I'm a plain old state trooper. I know what your beef is, and it's the same beef I had when I first heard about this Veritas idea being used over in France and Spain and Italy. Hey, I said to myself, that thing's gonna put me outta work! If there ain't no more crooks, then there ain't gonna be no more cops, and I'm getting pretty old to find an honest job, heh heh.

"Well, if you think this through, as I'm sure you will, being lawyers after all, you'll come to the same conclusion that I did: this Veritas gadget isn't going to mean there won't be *no* more crooks, it just means that we're gonna catch an awful lot *more* of them, and awful fast. In fact, we're hoping we're gonna be able to catch *all* of them. But the ones that we *do* catch and put away are gonna get out someday, and a lot of them are

going to go right back to crime, so we'll catch 'em again, and then maybe again after that. And there's always gonna be some new ones coming along. Now, the crime rate is gonna go way down 'cause most of the crooks are gonna be in prison, right? but in the meantime you're forgetting that we're catching *all* of the crooks, not just 15% like we are today. And *that* means that every single one of those 85% we never caught before *is gonna need a lawyer!* 'Cause just because a guy confesses doesn't mean he doesn't need a lawyer, does it now?

"In fact, I'd say that's when he *really* needs a lawyer!

"And whatta you people think I am, anyhow? The Gestapo or something? You think the Congress and the states are gonna permit a bunch of dumbass cops to just grab everybody in sight whenever some crime's been committed and just start jabbing needles into 'em and listen to 'em confess to everything from the time they stole an apple off their neighbor's tree, up to the time they thought dirty thoughts about their neighbor's wife?

"Hell *no!* You *know* that this Veritas gimmick is gonna be run just the way wire-tapping is today, with a court order given the same way a search warrant is, on the basis of some reasonable evidence justifying a search to be made, and then you just *know* there's gonna be lawyers, and *more* lawyers, just coming out of our *ears* anytime we start to hook up that old Veritas machine.

"Well, I'm sorry to get carried away with myself there, counselors, but I guess I was beginning to think this was another campaign speech, what with speculating about all the new business we're gonna be bringing you ladies and gentlemen, and I was all ready there for a minute to start asking you all for your contributions!"

August 3, 1986

The meeting of the Capos took place on carefully chosen neutral ground in a medium-sized Texas city where the local gun-slingers were more than competent to handle their own affairs without being told how to do it by a bunch of foreigners from the big city.

"I am *told*," said Don Tarchinini, Capo di Capi, who had objected strenuously to the waste of time this meeting would incur, "by some *very* expensive advisors, that we have nothing to worry about."

"This amendment business doesn't scare you then?" inquired Don Correnti delicately. "You personally have nothing to fear from electrodes being attached to your head, and all your family business being made known to every flatfoot in the United States?"

"Like they been doing in Italy and Sicily, huh?" grunted Don Pancrazio, who had recently seen 67 Sicilian relatives hauled off in ignominy to an Italian prison island. "That don't worry you none, huh?"

"Or the fact that the cops been shakin' us down for millions of bucks to run their own campaign!" shouted Don Luzzatti, who was still smarting over the expenses necessitated by the recent demise of his employee, Mr. Muhammad of Harlem. "They got the nerve to want to use *our* money to put *us* in jail!"

"Gentlemen, *please*," implored Don Tarchinini, "let us not become hyster-

ical about nothing. This is the United States, not Italy or France. These brainwashing laws cannot just be passed from one day to the next. May I remind you that it will need an amendment to the Constitution of the United States, and that in *two hundred years* there have been only *twenty-eight* amendments. I tell you, it is almost *impossible* to amend the Constitution, as our friends the equal-rights-for-ladies people have recently discovered."

"So you say, Don Tarchinini," replied Don Zanardelli politely. "But perhaps you would inform us just what makes it so difficult that we none of us have to worry."

"It's a simple question of mathematics," said Don Tarchinini condescendingly. "In order for an amendment to be made, it must first be proposed and passed by *both* houses of the Congress, the Senate and the House of Representatives."

"Which is exactly why all these cops are running for office, just so they can pass it in the Congress," explained Don Correnti, as to a small and backward child.

"Of course," smiled Don Tarchinini tolerantly. "But don't you know that it takes *two-thirds* of each house to vote for passage of the amendment? Two-thirds, gentlemen. That means 67 senators and 290 representatives. First of all, you can't get that many congressmen to agree that the sun comes up in the east. Secondly, there's no way in the world the flatfoots will be elected in any such numbers. For instance: there are only 34 Senate seats up for election this year and you need 67 seats for passage. I ask you all: how then can they take over the Senate?"

Don Pancrazio glared sullenly. "Would you care to bet your life on that?" he rasped balefully.

Don Tarchinini sat up with a start. "Humph. I think all of you are overreacting to nothing, but perhaps perhaps we should all find a little more money to, er, help support the, er, Republican or Democrat of our choice, eh? After all, we do have friends of our own in Congress right now, do we not? It probably won't cost a lot extra to ensure that they stay there. And that these coppers never make it."

August 27, 1986

Deputy Sheriff Dale Branner, Republican Candidate:

"There's an old saying that you can judge a man by his enemies. Well, let's take a look at *my* enemies, and the enemies of my colleagues who are running on the same platform all over this great country of ours. Now, there may be some of you out there tonight who are saying, 'Well, why *should* you have any enemies? Who *is* there that doesn't want to support the idea of catching the crooks and putting them all in jail?' That's what a lot of you are thinking right now, but unfortunately, *you are wrong!*

"Let me tell you who my enemies are:

"The Mafia and all of organized crime is my enemy!

"The American Civil Liberties Union is my enemy!

"All the criminal lawyers who make a career out of keeping murderers and rapists out of jail are my enemies!

"And every crook in America who's ever committed a crime without being brought to trial and who is walking around free right now is my enemy!

"Now, it's easy to see why the *Mafia* is against me, because for the first time this Veritas process will give the law enforcement agencies the means of going right to the *top* of those rotten syndicates, right to the Godfathers themselves. They *know* that, and they don't *like* that, and there *is* something they can do about it! And they're doing it! They're spending millions and millions of dollars against us, they're doing everything possible to ensure that we're not elected!

"Now, they can't come right out openly the same way you good people can, and contribute to the candidate of your choice the way I'm gonna ask you all to contribute at the end of the speechifyin', so that makes it a *little* bit difficult for 'em, and another thing that makes it difficult for 'em is that I'm sure my opponent in this race is an honorable and upstanding man who would never in his life even for one minute *think* about touching a slimy nickel of Mafia money."

Deputy Sheriff Banner winked broadly at his audience. "And if he *did* think about it, why he knows that maybe a year or so from now, when I'm in the Congress, and the laws have been changed, and the authorities start poking around with this Veritas process to see just where the Mafia *has* been spending their money recently, why maybe my opponent would want to think *twice* before he accepted any of that dirty, stinking, blood-soaked Mafia money!"

* * *

September 14, 1986

Detective First Class Joseph Wehrmeister, Democratic Candidate:

"You ACLU types *make me sick!*"

"Now just a—"

"You've had *your* ten minutes, now it's *my* turn!"

"Gentlemen, *please!* This is a friendly debate over the issues, *not* a shouting match. Now then. Detective Wehrmeister?"

"Thank you. As I was saying before I was interrupted by my Ivy League friend over there, for thirty years I've watched the ACLU cry about the rights of the criminals and never once say a word about the rights of the victims or the rights of society. Okay, fine, they've gutted our courts and shackled our police forces, all that's beating a dead horse, and I hope they're happy with the results.

"But now there's this Veritas system, and wouldn't you know it, the ACLU is against that too. Automatically, without even thinking about it. Because all they can think about is that it might put a lot of crooks behind bars where they belong.

"What they *don't* think about is this:

"While the American Civil Liberties Union is so busy worrying about the rights of all those poor innocent people that might be railroaded off to prison by the wicked American Gestapo infringing on their sacred civil rights, *why aren't they thinking about all the innocent people they say are already in prison that this process could free?*

"Now. Today.

"Let's write it right into the Constitution: any person already accused of or found guilty of any crime whatsoever

shall have the right to demand an immediate test by the Veritas process. If that process shall show his innocence, that person shall be freed at once with a full and free pardon.

"So you think the jails are full of innocent people, Mr. ACLU?

"I say, let's find out.

"I say, let's put the *guilty* ones away and let the *innocent* ones out.

"And that's what *I* would call civil rights!

"And what do you say to *that*, Mr. ACLU?"

September 16, 1982

"What on earth do you want from *us?*" wondered the chief lobbyist of the National Rifle Association, as he sat in his office in the shadow of the Capitol. "Naturally, all of us are certainly in favor of law and or—"

"What I want is for your guys to put up or shut up," interrupted Captain Daniel Murkowski, executive director of the National Chapter of Benevolent Organizations of State Policemen. "For twenty years now I been listening to you drugstore cowboys sound off about people killing people, not guns killing people. Right?"

"Well, er," replied the NRA lobbyist, who had grown accustomed to the normal deference accorded him by United States senators.

"Okay then. You guys are gonna get off the pot, or you're stupider than I think you are. You've been saying that only *criminals* use guns to kill people, right? Well, *here's your chance to prove it!* Help us get our guys elected to Congress and this amendment put through and what happens, huh? Every mothering, sonsabitching crook in the United States gets himself thrown in the slammer, and where does that leave *you*, Mr. NRA?"

"Wellll .

"It leaves ya right where you *wanna* be, you nudnik! All the crooks are in jail, right? So the bad guys don't *have* any more guns, right? Only you *good* guys in the NRA got guns, right? And—" Captain Murkowski waggled an enormous forefinger—"if only you *good* guys got guns, there won't be no more people killing *other* people with guns, will there? And if there isn't nobody else being killed by guns, then all the rest of the people what ain't got any guns at all won't give a good hoot in hell if all of you assholes in the NRA stock up your whole mothering *houses* with enough guns to fight the friggin' Second World War, will they?"

"Your manner is *remarkably* offensive, Cap—"

"And then they'll stop trying to promote legislation to take your little old guns away from you, won't they?" he added softly, the voice of sweet reason.

"—but, of course, you may well be right." The lobbyist tapped his walnut desktop thoughtfully. "In fact, now that you make it all so clear, I'm almost *certain* that you're right. So I repeat: what do you want from us?"

"First, money—to get as many of us elected as possible. And beginning right now, all 1,400,000 of your members out drumming up support for our candidates, ringing doorbells, pounding the pavements, holding meetings. All that stuff. And then, of course, a 100% turnout of your guys at the polls. Almost everyone else in this damn country is

too lazy to vote, so it don't take an awful lot of determined people to elect a congressman in an off-year election."

"Ain't it the truth, brother," the NRA lobbyist agreed smugly.

"And finally. Every string your lobby can pull, once we're in Congress and trying to get the amendment through. You already got half-a-dozen senators and a couple dozen congressmen in your hip pockets, right? and most of the others ready to roll over and pant whenever you tell 'em to. Well, if they're still there after November, we're gonna need 'em all and we're gonna need guys like you to put the fear of God in 'em. Right?" Captain Murkowski raised himself ponderously to his feet.

"Right." The NRA lobbyist smiled minutely as they shook hands.

Captain Murkowski beamed hugely. "And then I guess after we've saved your precious guns for all you nuts, *you'll* be out of a lobbying job, won't you, you asshole?" he said. But only to himself.

September 29, 1986

"The whole thing is a bafflement," said the president to his wife as they sipped martinis in their private quarters in the East Wing of the White House. "On the one hand, I have a gut feeling that something should be done about the animals before they take over this country, and I think Veritas could do it. On the *other* hand, this constitutional amendment seems over-drastic and, well, somehow *unconstitutional*, even though that doesn't make any sense."

"Well, it does *sound* unconstitutional somehow "

"What most people don't understand is that the Constitution isn't immutable. If you want to start an argument the next time we have people in for dinner, try this: tell them that the Congress and the States could ratify an amendment which declared null and void every single word and clause of the Constitution and its amendments preceding this particular one, and that henceforth the United States would be a satanic monarchy to be ruled by the anti-pope."

"What? I don't believe it!"

"Perfectly constitutional, my dear." He poured himself a second glass. "And on yet *another* hand, if all these wretched policemen and whatnot succeed in getting themselves elected, even calling themselves Republicans and Democrats, that will pretty well kill the regular two-party system, which up to now has always been able to prevent this kind of thing from happening, and which I happen to think is at least as important to the stability of this country as the Constitution itself."

He sighed. "And on a *fourth* hand, if I *don't* come out in support of it, and this movement succeeds, then where am I going to be when it comes time for re-election two years from now?

"And on the *other*—"

"Hush, dear, let me pour you another martini."

"A man would have to have as many hands as a bloody *octopus* to figure this one out!"

October 5, 1986

"I'm getting bad vibes on this thing," said the director of the New York office to the Executive Board of the American Civil Liberties Union at a hastily con-

vened emergency meeting in Cleveland, Ohio. "The hate mail and threats are way up."

The Chicago representative nodded. "The worst since we defended the right of those Nazis to hold a parade out our way seven or eight years ago."

The member from San Francisco had served since the end of World War II. "Which was *nothing* compared to the heyday of McCarthyism, and this is as bad as that."

"Well, what else *can* we do?" demanded the Boston representative. "We *must* oppose this campaign with everything we can. This is clearly the most naked threat to our liberties in the two hundred years of the Constitution."

"Pure fascism."

"The opening wedge to the police state."

"What comes next—concentration camps, the gulag, the ovens?"

"The blacks—"

"The Jews—"

"Gentlemen." The chairman rapped for order. "We are not here to enjoy a collective hysteria, we are here to discuss this unprecedented smear campaign being mounted against us. Not content to merely brand us as the defender of common criminals, we are now being openly linked with the Mafia."

"Which, from a certain point of view, is correct," said the Atlanta director, who prided himself on his hardheaded realism. "After all, it's undeniably true that we're both opposed to this measure."

"That's what I wanted to discuss," said the chairman. "Does it, in fact, make good sense for us to oppose this measure?" He sat back and waited for the hubbub to subside. "Believe me, gentlemen, no one is more opposed to this barbaric idea than I, but I also believe we should look at the situation realistically. *What, after all, are the chances of this amendment becoming law?* Why should we go to the wall fighting a battle that will be won without our help in *any* case?"

"But—"

The chairman sighed. "Look, the Constitution is quite specific. First, two-thirds of both the House and the Senate will have to propose the amendment, which I think is very dubious indeed. For instance, our friend Senator Powell is still chairman of the Senate Judiciary Committee—he can do more to deter its passage than a thousand speeches by any of us.

"*Then, three-quarters of the fifty States have to ratify the amendment.* Three-quarters, gentlemen! In *ten years* we were unable to get three-quarters of the States to ratify the equal rights amendment for women. What makes you think that this will be any different?"

"Not the same thing," insisted the New York director, shaking his head stubbornly. "You're misreading the mood of the country. It's scared, and it's ugly."

The representative from Austin was their pre-eminent constitutional historian. "The 26th Amendment," he said dryly, "which lowered the voting age to eighteen—at one time considered an absurd idea—was ratified by the necessary thirty-eight states in just under four months. Four *months!* Proposed by Congress on March 8, 1971; a part of

the Constitution on July 1st. So I advise you to never take anything for granted."

"Nevertheless," persisted the chairman, "I believe that we are endangering our organization and everything we've gained over the years by associating ourselves for insufficient cause with those dubious elements opposing this measure. I move that we issue a statement declaring our complete neutrality, and follow that up by ignoring the matter completely. When the proposition eventually blows over, as it will, let the American people blame the Mafia, *not* the ACLU."

"Vote."

The motion to observe a strict neutrality carried by eight to seven.

There were three resignations from the board.

November 4, 1986

Don Pancrazio reached Don Tarchinini by phone late that evening.

"You've been following the election returns, I imagine?" he inquired derisively.

"Well—" began Don Tarchinini defensively.

"Oh, you haven't? Then you don't know there are now 285 coppers elected to the House, which I believe is only 5 short of the 290 you so kindly told us makes up two-thirds of the House."

"Don Pancrazio—"

"And 27 of them in the Senate. And 21 of them as state governors, ready to start pushing for ratification once it's out of Congress!"

"*If*, Don Pancrazio, *if* it gets out of Congress. I urge—"

But Don Pancrazio had hung up.

From the *Congressional Record* of January 28, 1987:

Senator Powell (D-Ark.), Chairman of the Senate Judiciary Committee, at the hearing on the proposed amendment: Two things should be clearly spelled out in the amendment itself to prevent any possible abuse. One: that this so-called Veritas process can only be used upon approval by the competent judiciary authority, and that it cannot, and shall not, ever be employed by any branch of the executive or legislative for any purposes whatsoever. I particularly have in mind here the possible abuse of this process by the Internal Revenue Service and—

Senator Thibideaux (R-La.): I'll drink to that!

(Applause)

Senator Faber (Ind-N.Y.): Well, what about Congressional Investigating Committees; why shouldn't they be able to use it? Just the way they can grant immunity to witnesses, and throw them in jail for contempt and so forth. All that's pretty judicial, it seems to me.

Senator Powell: I must admit, I hadn't thought of that. Well, we'll have to discuss that aspect also. The other point I wanted to make, which I think must be written into the amendment, is that it must not be used *ex post facto*, that is, rectroactively for any crimes committed before the amendment is ratified.

Senator Martinez (R-N.M.): Well, why not?

Senator Powell: Well, I mean, there's a sort of tradition in Anglo-Saxon law, you can't punish somebody for something he did before a new law makes it into a crime. I guess you could call it a kind of fair-play notion.

Senator Martinez: Well, in this case,

I think it's a fat-headed kind of notion. You're talking about prosecuting someone for acts which weren't crimes before a certain date—that's one thing. This amendment would address itself to acts which were crimes at any date—that's another thing.

Senator Powell: But—

Senator Martinez: In other words, you're saying: "Go ahead, rape and kill and steal up until we pass this amendment and we won't do anything to you; but don't do it afterwards or we'll put you in jail." That's patently ridiculous.

Senator Grey (D-Calif.): I believe this argument is largely moot; protection against *ex post facto* is already amply provided for elsewhere in the Constitution, for instance—

Senator Powell: If the Senators would let me finish, I was going to say that this process must not be used retroactively except that it is the inalienable right of any person convicted prior to the ratification of this amendment to use it in the attempt to clear himself.

Senator Martinez: That sure sounds like *ex post facto* to me.

Senator Powell: It can sound like anything you like, Senator, but I don't believe the American people will buy this amendment unless we put these fair-play provisions into it, and as chairman of this Committee I'm telling you that this proposed amendment will never get out of committee unless it's drawn up to meet my approval.

February 1, 1987

Don Tarchinini's modest two-story frame house in a secluded part of Staten Island was hit simultaneously by laser-guided antitank missiles fired from three different vantage points. By the time four minutes later that the thirty-seventh missile had been launched there was no part of the smoking rubble more than three feet high save two spindly water pipes.

Don Correnti and Don Cadorna, like Don Tarchinini fatally stigmatized by Don Pancrazio as weak-kneed men of vacillation, also incurred less dramatic but equally conclusive accidents that evening.

Don Pancrazio smiled grimly as the reports came in. "We now have a free hand for Operation Wipeout," he exulted, carefully scrutinizing his Patek Philippe chronometer. "It will begin tomorrow at ten hundred hours," he added flatly. For Don Pancrazio was an incurable fan of old war movies.

The source of the leak was never revealed. As it was, it nearly came too late: it was not until 9:34 the following morning, Groundhog Day, that the tip-off reached the Secret Service. Operation Wipeout would begin in 26 minutes. By prodigious efforts of communications and of cooperation between thousands of hastily mobilized police, FBI agents, and the Secret Service, the death toll by the end of the day was a mere 17 congressmen, six senators, and two governors.

In the firestorm which swept the country for the next 48 hours as enraged law enforcement officials arrested some 3,352 alleged Mafiosi, 1,421 were said to have been so ill-intentioned as to have resisted arrest. None of them, including Don Pancrazio, would ever resist again.

February 12, 1987

In the full flush of outrage and

grief—three congressmen and a senator from New York being among the victims—the State Legislature of New York, meeting in Albany, quickly passed a bill ordaining mandatory life sentences without possibility of parole for all acts of what previously had been differentiated as first, second, and third degree murder. Forty minutes later it was signed into law by Governor Shupryt. The legislatures of 17 other states began to consider similar measures.

February 13, 1987

Long cherished by connoisseurs as an exemplar of that old-time senatorial dramaturgy now so sadly in decline, Senator Galloway (D-S.C.) outdid himself by being borne by stretcher, heavily swathed in bandages, into the chamber of the Senate to cast his vote solemnly in favor of the proposed 29th Amendment. Eighty-two of his colleagues joined him to vote aye, while only 4 nays were recorded. In the House the vote was 387 to 9 in favor. The 29th Amendment, having been proposed by both Houses of Congress, as specified by the Constitution, now went to the fifty States for ratification.

PROPOSED ARTICLE OF AMENDMENT

1.) That provision of the fifth article of amendment to the Constitution of the United States which reads: "nor shall be compelled in any criminal case to be a witness against himself," is hereby repealed.

2.) All other provisions of the fifth article of amendment to the Constitution shall remain operative.

3.) Any person may be compelled in any criminal case, excepting only those concerning the levying of taxes upon incomes of whatever source, to be a witness against himself; provided that the means of compulsion are neither cruel nor unusual nor involving physical torture or mental stress, as defined by the Congress and the several States; and provided that the process of compulsion shall be applied only after a warrant shall be issued upon probable cause, supported by oath or affirmation, and particularly describing the crime committed or believed to have been committed.

4.) This article shall be operative only upon crimes committed after the ratification of this article; except that any person convicted prior to the ratification of this article for any crime, or under indictment thereof, shall have the right to demand the application of the same process of compulsion to determine his guilt or innocence; and if he shall be shown innocent, he shall receive a pardon from the relevant authority.

5.) The Congress and the several States shall have concurrent power to enforce this article by appropriate legislation.

6.) This article shall be inoperative, unless it shall have been ratified as an amendment to the Constitution by the legislatures of three-fourths of the several States within seven years from the date of its submission.

February 26, 1987

"It's quite clear," said the Los Angeles director of the ACLU, "That most of these men were simply murdered in cold blood, gunned down in the streets,

sometimes as they literally begged for mercy.''

''Outrageous.''

''Despicable.''

''The police state is here.''

''I said at the time that it was a shocking betrayal of our principles that we should back off in the fight against the 29th Amendment. I think it is now evident that we were grievously mistaken. We are now confronted with perhaps the most blatant assault on American civil liberties within our lifetime. I move that we redeem ourselves from our moment of dishonor by a two-fold program.

''First, that we do everything within our power to see indicted, tried, and convicted those hundreds of Gestapo agents responsible for the murders of some 1,421 alleged Mafiosos, whose only proven 'crime' was to be a member of the Italo-American community.''

''Hear! Hear!''

''Second, that we provide all possible legal services to those other thousands of Italo-Americans currently incarcerated as so-called suspects in the admittedly cowardly and unjustifiable murders of a number of public officials.''

The vote was 11 to 3, with only two resignations following the vote.

March 3, 1987

''I've got these damned ACLU characters coming out of my ears,'' complained the attorney general to the president.

''I know, they've been around here too, but so far I've managed to avoid seeing them. What, specifically, do they want?''

''A federal task force, thank you, including, but not limited to, the FBI, to investigate the conspiracy to violate the civil rights of all those Mafiosos who got themselves blown away on Groundhog Day.''

The president fingered his chin. ''They really *were* Mafioso, I take it?''

''Oh yes, not a doubt. Most of them we'd been after for years.''

''Well, in that case, it is my considered opinion that every mother's son of them was shot while violently resisting legal arrest, just as the cops have been saying. There was therefore no conspiracy to violate their civil rights, and no branch of the United States government which is responsible to me will spend one nickel investigating an imaginary conspiracy.''

''They're going to raise an awful stink,'' cautioned the attorney general.

The president was a superb practical politician who had never needed to consult a weather vane to determine which way the wind was blowing. ''Let 'em,'' he said simply.

March 27, 1987

In spite of the best efforts of the ACLU and the Citizens' League of Justice for Italo-Americans to turn their attention to the plight of the 1,932 incarcerated Mafiosi (alleged)—or perhaps *because* of these efforts—the legislative bodies of thirty-eight states stubbornly refused to disregard the deaths of six senators, 17 congressmen, and two governors. They ratified the proposed amendment just 41 days after it left the Congress. Arizona was the thirty-eighth state, and at 5:34 (EST) that afternoon, the 29th Amendment officially became a part of the Constitution of the United States. In the next

year every other state except Massachusetts would go on record in favor of ratification.

March 30—April 4, 1987

The first state to pass a bill legislating the use of the Veritas process was Nevada. Maine and Ohio followed suit the next day, while New York and three more adopted theirs by the end of the week.

Only a handful of people were aware—and of these, no one cared—that a certain Jimmy Lickert, who had spent the last 386 days in a coma as a consequence of a number of police bullets being fired into his head during the raid upon Abdul Muhammad's numbers shop, sat up suddenly in bed that weekend, wrenching a number of tubes and attachments from himself, emitted a single loud gurgle, and fell back dead.

May 29, 1987

"A fine pickle we're in," said the new chairman of the ACLU, a gentleman from Portland, Oregon. "Everything you've done, no; *we've* done in the past year seems to have backfired upon us." His gaze travelled around the table accusingly. "*Including* the pressure you—no, *we* put on Senator Powell to force that *ex post facto* clause into the amendment, even *that* is working against us."

"It's completely unfair," complained the San Francisco director. "In fact, *damned* unfair. Why, they've already found sixteen people in California prisons that this damned Veritas says are innocent, and they've been released and pardoned and all that, and now what are they doing? Instead of just being decently thankful, two of them are suing *us* for a hundred million because, they say, we opposed the Veritas process, knowing them to be falsely incarcerated, and that therefore we, the California Chapter of the ACLU, were in conspiracy to violate their civil rights!"

"Yes, yes," said the chairman testily, "what else could you expect in California? But what *I'm* talking about is this: we *know* there are several hundred, perhaps thousands, of policemen responsible for the Groundhog Day Massacre. The FBI refuses to investigate, the attorney general refuses to intervene, the president refuses to receive us. The police departments involved have all conducted so-called investigations which *in every single case* has exonerated *every single* policeman involved. No grand jury has handed down even a single indictment." He pounded the table in frustration. "If *only* we could *force* them to use Veritas on those those *murderers!*"

"But if they used it retroactively on those cops, then they'd be bound to use it retroactively on all of our, er, Italo-American clients," pointed out the realist from Atlanta. "Do you think *that* would be a Good Thing?" he added silkenly.

The chairman shot him a look of singular hatred, but refrained from any gesture more physical than gritting his teeth.

"An interesting point, that," mused the representative from New York. "The *ex post facto* notion, I mean. Let's say that Mr. A. kills Mr. B on March 26, 1987, the day before the 29th is ratified. Veritas cannot be used to de-

termine his guilt or innocence of murder."

"What's so interesting about that?" snapped the delegate from Boston. "If you'd open your ears you know that's what we've just been bitching about."

"But suppose A merely *shoots* B on March 26th, wounding him severely, but not killing him. Then what?"

"Then it's grievous bodily harm, of course, or attempted murder, or something of that nature, and you *still* can't use Veritas, because it's *still* retroactive to the 29th, and so what?"

"So this: let's suppose that B has been shot on the 26th, right? What happens if he just happens to take a turn for the worse and die on the 28th, two days *later*, the day *after* the 29th becomes operative? What then, hmmm?" He sat back smugly.

"Ah hah!" said the representative from Chicago, the flicker of a smile on his lips. "You mean "

"Exactly! Grievous bodily harm the day *before*, murder one the day *after*. And surely, gentlemen, that case of murder one could not be considered retroactive to the passage of the 29th, since by definition it occurred the day after! And Veritas can be used!"

"But that doesn't do us any good at all with the Groundhog Day Massacre," objected the Chairman. "All of those Mafio— er, Italo-Americans were dead long before ratification."

The representative from New York sighed. "True. Unfortunately, all too true. However, one must obtain satisfaction where one can, and in any case, the principle of justice remains the same, whether it be for a thousand deaths or for one."

"One?"

"One. A gentleman named Jimmy Lickert, who chanced to die a few weeks ago in New York. I just remembered it quite by chance. Let me tell you gentlemen about it "

July 3, 1987

From where he floated up by the ceiling, Patrolman Denio Sanchez listened, with no great interest, to the words forming themselves somewhere within his consciousness and simultaneously issuing forth from what appeared to be his own body down below. It was a curious, even pleasant sensation, floating here, disembodied. If only he could be left alone to absorb and understand the full implications without this distracting conversation that part of his mind seemed to want to carry on

"—so we picked up three or four, yes, it was four, guns without serial numbers or anything from the supply we've accumulated over the years down at the station house, and took them with us. After we'd shot Abdul Muhammad and Lickert and whatever the name of the other man was, we put three of the guns in their hands and then squeezed their hands and fingers until the guns had all fired several times each into the walls and like that."

"And what did you feel as you shot Abdul Muhammad?"

"I thought, 'Gee, doesn't he look surprised?' "

December 14, 1987

"That's beautiful!" shouted the president in the general direction of his attorney general. "The first people to be convicted of first-degree, premeditated murder, and sentenced to mandatory life sentences because of the Veritas system are seven New York City police officers, including a captain! And for knocking over a couple of hoodlums! That's really *beautiful!*"

"Just one hoodlum," said the solicitor general soothingly. "The other two died before the 29th and don't count."

The president snorted contemptuously at this legal nicety. "So they're up the river in Attica for the rest of their lives without possibility of parole, and every cop in Congress and in the country and fifty million other people are all pressuring me for a pardon! So tell me this, gentlemen: what do I do?

"What do I do *now?*" ■

● One may well ask, "How can you advocate breaking some laws and obeying others?" There are two types of laws, just and unjust. One has not only a legal but a moral responsibility to obey just laws. One has a moral responsibility to disobey unjust laws. Any law that uplifts human personality is just, any law that degrades human personality is unjust.

Martin Luther King

Jay Kay Klein's biolog

Obscured though it often is by a 35-mm. Leica with multiple attachments, the face of Jay Kay Klein is familiar to thousands of science fiction convention-goers. In 20-odd years of attending conventions all over the world, he has taken more than 30,000 black-and-white photographs of science fiction events and people and any number of color slides. His slide show, "The Decline and Fall of Practically Everybody," is a standard comic-relief item on many convention programs.

Jay Kay purchased his first camera as a freshman at Syracuse University and began a self-study course that included reading every book on photography in the university library and complete sets of several photography magazines. "I read these through chronologically, getting an understanding of what went on before and bringing myself up to date almost as if I'd lived through the entire development of the field," he says. "I did the identical thing in science fiction, having read all the old magazines." (He lacks only nine issues toward a complete set of *Astounding/Analog*.)

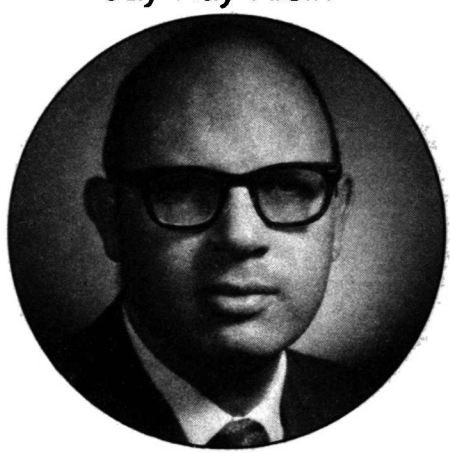
After earning a B.A. (cum laude) with dual major in anthropology and journalism, Jay Kay spent time in the Army, then returned to Syracuse with a scholarship for four years of graduate study in English. He became friendly with the university radio station's chief engineer who, via long telephone conversations, taught Jay Kay electronics and how to play the guitar.

Modeling himself on John W. Campbell's "ideal man," Jay Kay has read widely in many scientific areas. "I've always felt most learning is done outside classrooms and formal courses," he says. "I learned engineering concepts from Robert A. Heinlein, ethics from E.E. Smith, and a fair percentage of my total makeup from the lifelong home study course offered in the pages of *Analog*." His employment history reflects this technical bent: writer of instruction manuals dealing with military radar ("For a time America's defense posture rested partly on someone who had studied electronics over the telephone," he says), advertising and sales promotion for General Electric's semiconductor division; public relations (specializing in air conditioning) for Carrier International. That company was recently taken over by a giant conglomerate, and Jay Kay was let go; he has spent the time since as a freelance writer and photographer in the Syracuse, New York, area. Spare-time interests include amateur astronomy—he owns a clock-driven equatorial Unitron refractor—amateur radio operation, playing the guitar, and cooking; he owns more than 300 cookbooks.

Jay Kay's dedication to chronicling the SF world on film has earned him a Science Fiction Writers of America President's Plaque, recognition as Fan Guest of Honor at the 1974 World Science Fiction Convention, and—most importantly, says Jay Kay—the friendship of authors, editors, artists, and fans the world over. ■

—Elizabeth Mitchell

Jay Kay Klein



THE BLIVIT IN THE B-RING

The thing in the B-ring is definitely not "ordinary"—but what is it?

Conclusion

Richard C. Hoagland

Part I detailed the discovery of a powerful, apparently random source of broad-band radio emission by VOYAGER I, during the November 1980 fly-by of the planet Saturn. The emissions, picked up by Dr. James Warwick's Planetary Radio Astronomy experiment receiver, periodically faded and swelled, revealing to Dr. David "Doc" Evans—a member of the Warwick team—a repetition indicative of an orbit at 1.8 radii from the center of the planet. Such an orbit placed the mysterious "object" almost in the middle of Saturn's "B-ring"—the one which VOYAGER itself discovered to possess the most bewildering array of unexpected detail. There was immediate suspicion that the two facts were related.

Proposals for the source of strange radio energy originally centered on an "accreting moonlet," until it was de-

termined that several observed characteristics of the VOYAGER signal — including polarization hinting at a powerful magnetic field—can't be matched by any tinkering with a model centering on an icy lump of ice.

At this point I arrived in Boulder, Colorado (home of Warwick's research company, Radiophysics, Inc.) and proposed that the extraordinary emission is, in fact, generated by a primordial black hole, *captured somehow in Saturn's rings. The team generously includes this possibility in their continuing pursuit of "the thing in the ring."*

Part of their receptivity is predicated on confirmation (via a completely independent VOYAGER experiment—the photopolarimeter (PPS) instrument) of an extremely narrow "canyon" in an otherwise impenetrable 3000-mile-wide section of the B-ring. When the orbital period of an object in that gap is calculated, with the aid of Dr. John Anderson at JPL, its 10-hour, 9-minute, 4-second orbit matches exactly *(within the statistics) Evans's 10-hour, 10-minute period, calculated from the radio bursts.*

Whatever creates the gap, and whatever is spewing prodigious radio emission into space, is one.

The very insignificance of that gap, however, confounds the original problem: the source of the radio emission, called by Warwick SED (for Saturn Electrostatic Discharges). A simple comparison reveals that the "thing" in Saturn's B-ring is dissipating continent-equivalent energies within a volume the dimensions of a football stadium — roughly a trillion times *the energy density of the entire Io Torus at Jupiter.*

Yet there is no observable effect in any other VOYAGER instrument when they look at the rings!

Since it impinges directly on what VOYAGER has serendipitously detected in the Saturnian rings, let's examine in a bit more detail the comparison between the phenomena VOYAGER observed at Jupiter and what seems to be *indetectable* at Saturn.

Specifically, the VOYAGER UV (ultraviolet) experiment was the first to discover the Io Torus, while the spacecraft was still tens of millions of miles distant from Jupiter back in the early spring of 1979. For an object releasing roughly equivalent energy within the ring environment, one would expect some telltale indications from that instrument—excited ion species, copious high-temperature molecules or atoms

something.

The UV instrument saw nothing.

The only "suspicious" observation which it registered was a much higher than expected density of *neutral* hydrogen atoms. The presumed source of this hydrogen is ultraviolet sputtering of water vapor off the icy ring particles. The hydrogen would be released as the water molecules were split apart by absorption of energetic photons from the sun. But, there could be another explanation: that the raw power of the "thing" melts ring particles, releasing water vapor—and hydrogen.

One of the best arguments for the object being a primordial black hole was this sheer power density.

Contrary to popular opinion, black holes can be prodigious sources of raw energy. Numerous calculations across the past ten years, from Russian theoretical astrophysics to the published papers of Remo Ruffini, Wheeler's one-time colleague at Princeton, have made it clear that in the vicinity of a black hole extremely energetic processes can take place, releasing both high-energy particles and electromagnetic radiation. The production mechanism has nothing to do with the terminal evaporation process discussed earlier, which applies only to mini-holes on the threshold of catastrophic decay. This process, rather, relates to the fact that black holes *spin*. It is through this spin that, according to the calculations, a black hole can impart enormous energy to both particles and electromagnetic waves entering its proximity, through a process of transfer of angular momentum from the black hole itself.

Furthermore, as matter enters this critical region around a black hole, it is annihilated—literally squeezed into sub-atomic particles by the incomprehensible gravity of the collapsed object. The math done on this process across the past decade or so indicates that up to about 45%—almost half—the "rest mass" of approaching "stuff" can be converted into energy this way, energy which radiates away from the black hole itself. The rest, of course, dives into the singularity, where it literally disappears from the observable universe.

If this wasn't enough to make a black hole, somehow orbiting Saturn amid all those trillions of ring particles, "visible"—from emitted radiation, as it "swallowed" bits of ringstuff from time to time — there was a *third* process whereby such a unique object might betray itself.

Saturn's all-encompassing magnetic field.

For the past ten years the overwhelming consensus among members of this exclusive "club" considering the properties of these exotic objects has been that black holes are electrically neutral objects. The idea was that, though *theoretically* black holes can come with an electric charge, in the "real universe" such charge would instantly be neutralized by the attraction of oppositely charged molecules or atoms.

Only Remo Ruffini continued to insist that "charged black holes" had a reality within the universe other than being an academic possibility on paper.

The type of black hole I was proposing to the Warwick team was precisely such an object: one of Ruffini's charged black holes!

The process was quite simple. If a PBH was the object at $1.8R_s$ then, in addition to sitting in the ring environment, the mini-hole would be deep inside the Saturnian magnetic field. Field lines passing through or even close to such an object would be "swallowed," creating an enormous amplification of the field in the immediate vicinity. If in addition our PBH was spinning, then the twisting topology of space itself—a phenomenon called the "Lens-Thirring Effect"—would twist the field lines into a positively *weird* geometry, eventually creating a *charged electrical dynamo* in the extraordinarily amplified and sheared field lines surrounding such an object.

Fascinatingly, such a process previously has been called upon to explain the massive energies emitted by quasars and other exotic entities recently discovered.

Though merely trillionths of an inch across itself, the "field of influence" of a PBH via these effects should extend to several inches, creating a region both highly charged and capable of amplifying enormously a wide range of electromagnetic radiation. Incidentally, if the "sphere of energy generation" of the "thing" really is that small, the power density would exceed 10^{25} watts per cubic mile!

If this possibility—that the "thing" is a PBH—was real, then any one or even a combination of the above production processes could well explain the observed radio emission from the object. But productive models of these processes would in themselves be fiendishly complicated projects.

The variation in the number of events between the two encounters, so difficult to comprehend in terms of a variation in the source process of emission, could be easily explained—if the "thing" were something like a primordial black hole. The subtle gravitational perturbations, which apparently are generating "ripples" in the rings farther out, could also exist — but in much smaller amplitude — in the region of the source Warwick's experiment picked up. By controlling the number of "collisions" or "interactions" with ringstuff per unit time, these density waves could account for the decrease VOYAGER 2 observed.

It should be noted that in terms of actual emitted energy, the destruction of one "snowflake" a few microns (one ten-thousandth of an inch) across every few seconds would provide more than enough power for the "thing"—if it's a primordial black hole.

Skeptics may note that such an object must have (according to the "Hawking Limit") a *minimum mass* for it to continue to exist in the contemporary Universe, some 18 to 20 billion years after the Big Bang. That limit is on the order of four billion tons, the mass of a somewhat smallish asteroid. Proposing that the mass of our PBH could be anything, the crucial question to ask is, "How massive would it have to be to create its own observable gravitational effects — either on the other Saturnian moons, or on the rings themselves?"

We put this question to Dr. John Anderson, celestial mechanics expert at JPL, who has used the tracking data from the PIONEER and VOYAGER spacecraft to compute the masses of the planets and moons within these systems.

Using a computer program he developed expressly for this purpose (detecting mass perturbations in the Jovian and Saturnian moon-systems, not small black holes!), Anderson computed several figures: the period of an object in the rings which could create the "gap," and the maximum mass that an object orbiting within that gap could have and *not* cause perturbations in the other satellites. Here is the result of those two calculations.

The period turned out to be 10 hours, 9 minutes, 4 seconds (plus 3 seconds, minus 4 seconds)—almost exactly once

again Doc Evans's original estimate of "10 hours, 10 minutes."

The mass was even more surprising.

According to Anderson, one could "hide" an object with essentially the mass of Mimas—an inner moon of Saturn "weighing" about a hundredth of our own Moon—in an orbit close to Saturn, and its gravitational effects would not show up as suspicious motions in the orbits of the other moons! When questioned as to why this major mass would be "invisible" via such gravitational perturbations, his answer essentially boiled down to, "Because its effects would be hidden by its proximity to Saturn's 'bulge,' the distended mass that Saturn's rapid spin creates around its equatorial region."

Such a massive object could "hide" by virtue of its gravitational effect masquerading as a higher gravitational consequence of Saturn's own rotation!

This, then, places two constraints upon the mass of such an object: the lower limit of a billion or so tons set by the Hawking Limit; and the upper limit *ten million* times as large (10 million billion tons) defined by the lack of perceptible "anomalous motions" of Saturn's inner moons.

My initial guess was that the "thing" in Saturn's rings was somewhere near the lower limit.

One of the key reasons for this choice was the lack of any obvious commotion in the rings themselves.

Peter Goldreich and Scott Tremaine, two leading ring dynamicists, had proposed in 1978 a theory of "shepherd satellites" to account for the very narrow rings around Uranus, which had been adapted to explain the myriad detail in Saturn's rings as well. In this model, the presence of innumerable "kilometer-sized moonlets" in the B-ring created all the "grooves," by gravitationally clearing ring particles in their vicinity. According to their theory, a two-kilometer object (1.2 miles) should clear a gap two kilometers across. It is assumed, of course, that the moonlet has the density of ice.

The fact that PPS detected a gap only 300 *feet* across (and that the VOYAGER radio occultation experiment—shining the spacecraft's radio transmissions back through the rings the night of the first spacecraft fly-by—didn't detect *any* gap at all) was hard evidence that a "kilometer-sized icy moonlet" did not exist as the "thing" in Saturn's B-ring. If we strictly follow Goldreich's theory, then the mass of whatever is the "thing" can't be more than about one million tons—which would also seem to eliminate the PBH idea!

Unless what we're seeing is a PBH smaller than the so-called Hawking Limit—"kept alive" by eating Saturn ringstuff!

To my extreme delight (after presenting these ideas), Warwick and his colleagues didn't throw me out of the office, but expressed more than casual interest in all aspects of the model. Later I happened to be going somewhere with Joe Romig—the only true "relativistic physicist" on Warwick's team—and there, in the back seat of his car, several textbooks had appeared on these phenomena—including black holes.

There was even the specific work by

Remo Ruffini, on processes occurring in the vicinity of *charged* black holes!

It was then that I knew my trip had not been wasted.

In any case, whether what Warwick and his team have found turns out to be a primordial black hole or something else, the trip was certainly one of the more worthwhile odysseys I've ever taken. For, as a member of the journalistic community and not the highly segregated "club" which represents much of scientific endeavor in the world today, I might easily have met with cold reception to my ideas. The opposite occurred.

Which leaves the future.

In the months since that initial meeting in Boulder, Colorado, I've been privileged to share one of the rare experiences possible on Earth: the thrill of chasing down a new and truly wondrous discovery. In phone conversations and sometimes face to face, Warwick, Evans, Romig, and I exchange new data and constantly evolving ideas on the nature of the object. As of this writing, however, there is almost a bottomless abyss of speculation and very little firm information to base a model on.

One of the next milestones, in terms of finding out more information, will be an attempt to detect the "thing" via terrestrial observations.

Evans and Romig calculated not long after VOYAGER 1's original detection that the signal strength was great enough to register on existing radio astronomical facilities on Earth. Last spring they sent a proposal to that effect to those in charge of the Very Large Array, the Earth's largest and most sensitive radio facility. An assemblage of 27 "dishes" strung out along an ancient lakebed in central New Mexico, this facility has the resolution (if not the sensitivity) of a single radio antenna some twenty miles across!

The effort will be made at frequencies far higher than those VOYAGER received as it passed Saturn, as (at this writing) those are the only frequencies the VLA is equipped to detect. If the "thing" radiates in this region of the spectrum—around 1.4 gigahertz (1 billion 400 million cycles per second)—it will mean, for one thing, that the power estimates for the total energy radiated by the object will have to be revised once more—upward. It would be emitting ten times again the power VOYAGER detected from the object in November and again in August: not "merely" a hundred million watts, but a *billion* watts and (assuming the same efficiency of conversion of energy into this broad-band electromagnetic radiation) the total power in the object would also increase ten times:

To that figure of 100 gigawatts we alluded to before.

Thus, success for Warwick at the VLA would simultaneously deepen and provide new answers to this extraordinary mystery. In plain terms: How can so much energy be concentrated in a *single* object?

In recent weeks, in line with this persistent and as-yet-unanswerable question, Warwick and his team have proposed another "conventional" model for this strange phenomenon, this one essentially revolving around the PPS

discovery of the "hundred-meter gap" within the B-ring.

Says Warwick, "The gap, in effect, cuts the densest section of the ring in two, effectively *isolating* two broad sections of an enormous natural capacitor. Via this theory, not only do we believe we are making headway on what the object in the rings might be, we also can account for the spokes!"

All along, Warwick and his team intuitively have felt these two exotic phenomena were somehow fundamentally connected. "Spokes" are those other enigmatic structures in the B-ring. Lying *crosswise* on the ring itself, spokes are radial features apparently confined solely to the B-ring and composed of very fine material—micron-sized "dust" — elevated above and below the central ringplane proper. VOYAGER 2 carried out some short-time-resolution studies of the spokes (the so-called "spoke movie") which showed that these thin, radial features can form in mere minutes—across distances of thousands of miles. Spokes are apparently "painted" on the ring for up to half an hour. Then activity along a particular radial marking will subside, to be replaced by the creation of another spoke in another section of the ring far removed from the original spoke's location.

Carolyn Porco, a graduate student at Caltech, recently discovered an important correlation between spoke activity and the 10-hour, 39.4-minute radiation fluctuation in Saturn's SKR—the long radio emission which is thought to reflect the actual rotation of the solid core of Saturn. The link is thought to be through Saturn's magnetic field, which presumably rotates with the period derived from VOYAGER's detection of the SKR.

Thus spokes, somehow, are connected with the overall configuration of that field. They are seen to preferentially form when a certain longitude of Saturn (as defined by the radio emission) turns around each "morning" relative to a line between the planet and the sun. Why this relationship should exist, however, is not known.

Warwick's model for the spokes invokes the "cut capacitator model." In this theory, whatever the object is that forms the "thing" has literally cut a swath through the densest portion of the densest ring of Saturn. This, according to this newest effort to explain both the ring radio emitter and the spokes, has isolated these two sections of the rings.

Sunlight, particularly the ultraviolet radiation, constantly charges ring material. But because it is the lightest, the dust—the micron-sized debris—is most affected by this radiation. Being such minute flecks of mass, these "snowflakes" are relatively free to move in response to the combined electrical and magnetic fields created in this dust, as the rotating magnetic field of Saturn sweeps past charged dust particles.

This, according to Warwick, literally creates electric "winds" — blowing charged dust motes inward and outward across the orbital motion of the rings. The dust becomes something like a set of brush collectors in an enormous, planet-spanning generator, charging, via *friction*, snowball-sized debris in Sat-

urn's densest ring—on both sides of the gap the PPS discovered.

Warwick estimates that a potential of perhaps ten *million* volts has built up on opposite sides of this "hundred-meter canyon" in the B-ring. Spokes are formed when snowballs from opposite edges of this "canyon," perturbed by some gravitational disturbance — tides — from one of Saturn's moons, wander out across this gap within the rings.

Warwick envisions two oppositely charged snowballs meeting — colliding — somewhere in the gap or at its edge. The impact shatters the highly brittle ice (at these low temperatures) which make up "snowballs" in this strange environment, creating clouds of smaller particles—including lots of micron dust. Highly charged, this dust immediately tries to migrate *radially* across the "canyon," to the oppositely charged wall of snowballs.

Two oppositely charged clouds of particles leap out across the gap within the B-ring, passing through each other on their way toward the side which is attracting them with the potential of ten million volts. In effect, what Warwick's describing in the rings is a mechanism for the electrical acceleration of small particles—

A version of Gerard O'Neill's mass driver in the rings!

The Warwick team calculates that the production of these radially accelerated streams of highly charged dust clouds, literally "shot" in opposite directions from 1.8 R_s, should do far more than produce mere "spokes." They should, in fact, be *the* major source of small dust particles throughout the solar system!

Accelerated toward and away from Saturn in excess of some 20 miles per second, the material shot radially outward can easily escape from the gravitational field of the entire planet—to wander through the solar system until it is destroyed by various forces. Warwick's numbers indicate that, during the lifetime of the solar system, a mass equivalent to Tethys or Enceledus — small, inner moons of Saturn composed essentially of ice and "weighing" about a tenth the mass of our own moon—should have been shot away from Saturn by this process.

This number nicely correlates with the estimated mass of a moon which might have been destroyed (or failed to accrete) in the process that produced the rings themselves.

There is, however, one small problem (another one?)

The "thing" itself.

Without the presence of that object in the ringplane (which is also estimated to be merely "one hundred meters thin"), effectively cutting the B-ring into electrically separated halves, there is no "capacitator effect"—and thereby no process to form thousand-mile-long linear accelerators shooting dust motes out across the solar system.

So it is crucial for this comprehensive model to identify the nature of the object which initiates this process, by keeping those two "halves" of the B-ring isolated.

Joe Romig now believes it is a "cannonball."

When we discussed the bewildering

range of possibilities for what could cause the "thing," back in Boulder in November 1981, one of my favorites (after primordial black holes) was precisely such an object: the iron core of a one-time former moon. If the rings really are the product of some catastrophic destruction of a former moon, then it is reasonable to assume that such a satellite was similar to the other inner satellites of Saturn, particularly Mimas—which seems to have a small but significant rock and metal core (judging from the density measurements derived from VOYAGER's trajectory deflection).

Even if shattered by some gargantuan impact in the earlier history of Saturn, such a satellite's *core* should have survived the event and continued to orbit Saturn. It may be significant in this regard that *all* the planetary rings which we have seen so far, from Jupiter to Uranus, appear to have some solid, rocky body orbiting at 1.8 times the radius of the parent planet—a fact I noted and pointed out to Warwick recently. If this intriguing circumstance holds any physically significant information, it may lie in the distance/mass relationship with regard to the thermal radiation from these bodies soon after their formation. By acting like miniature "stars," all the giant planets apparently determined the chemical makeup of their inner satellites to some degree—by literally "boiling off" the lighter elements and molecules, depending on the distance of the forming satellites from their respective planets.

It has been argued, then, that this is why Io, the largest inner satellite of Jupiter, has a density indicating almost solid rock—while Ganymede, farther away, seems to be composed of a large percentage of ordinary water (in the form of ice). The initial temperature gradient between these respective satellites, determined by their respective distances from Jupiter in its "stellar phase," is now assumed to have created this chemical distinction in the composition of each respective moon.

By this reasoning (and for a couple of other reasons) the makeup of the "rocks" recently discovered orbiting Jupiter at 1.8 R_J—which, strikingly, is where Jupiter's thin ring *begins*—are suspected to consist of highly refractory elements: lots of iron oxides and assorted iron sulfides.

Exactly like the object Romig's now describing as the "thing" in Saturn's ring!

All right, let's assume it is a cannonball. How does it produce all that radio emission?

Again we call upon the snowballs making up the overwhelming population of the rings. Romig assumes that small perturbations will bring charged snowballs into contact with the mass of iron responsible for the "hundred-meter gap." As each small chunk of ice contacts the highly charged and massive "iron moon of Saturn," discharge events very similar to lightning can occur, with consequent release of broad-band radio emission.

Which brings us to the problem: How is it possible for such an iron moonlet to still exist—in the face of energy release which should have long ago destroyed it?

Assuming that the 10^8 watts measured by the spacecraft is the total energy released near the surface of this satellite, I took the time to calculate the mass of metal vaporized in any one "event" noted by VOYAGER as a burst of SED emission. Being highly conservative in terms of the number of watts per square centimeter of surface, percentage absorbed versus the percentage simply reflected, etc., I derived what I think is a reasonable number: 1 kilogram of iron lost for every discharge at the surface of the satellite.

Next I tallied up the mass of a "hundred-meter iron moon," assuming such an object fills the gap detected by the PPS. Intriguingly, such an object "weighs" just about one million tons — already too much if we go by Goldreich and Tremaine. But we'll continue.

Okay, eat away 10^6 tons at the rate of a kilogram or two every few seconds, and how long before your cannonball is gone? The answer was something of a shock: less than one hundred years

In other words, we were back to the uncomfortable problem of the statistical improbability of such an object existing in the rings for the duration of the solar system only to be on the verge of disappearing just as we arrive.

In a conversation with Joe Romig on this matter I learned that he had independently derived similar numbers, and was equally "uncomfortable."

The significance of this rough calculation becomes overwhelmingly apparent if we substitute the larger estimates for the amount of *total* energy involved with the source of radio emission. As we have said, if the usual efficiencies prevail, then there is a hundred times that amount of energy contained in that tiny volume which must be dissipated in some other process. The most obvious is thermal energy. Heat. And that could easily multiply by a factor of a thousand the amount of mass lost in each event—

Making the lifetime of the object less than a year in the five-billion-year-old history of Saturn!

However, let's live with that problem for a moment, and investigate a couple of separate observations which would suddenly "snap into place" if Romig's new model is for real.

For many years investigators noted that the rings are "reddened," that is, exhibit a pronounced spectral shift toward the red end of the visible spectrum compared to some neutral surface, say, the surface of one of the icy inner moons. Recently some observers have specifically identified the agent responsible for some of this "impurity" in an otherwise icy composition of the rings. They believe it's due to magnetite, a form of iron oxide.

If a "cannonball" had steadily been vaporizing in the rings for a hundred or so million years, it is not unreasonable to expect to see evidence of its contamination—as the vapor produced in each "event" plates out on snowballs in the immediate vicinity.

The second consequence of such a "vapor deposition process" would be to markedly enhance the reflectivity of all those snowballs to electromagnetic radiation.

In 1972 radar observations conducted

of the rings from Earth revealed a remarkable property of Saturn's rings at centimeter wavelengths—the gigahertz regime. The rings are incredible reflectors at these wavelengths. Furthermore, that reflectivity (over the range of frequencies reflected, across the gigahertz band) was remarkably *independent* of the wavelength sent. In other words, the reflectivity of ring particles is very *flat*—curiously similar to the behavior of the "thing" at much longer wavelengths. Is it possible that these peculiar electromagnetic properties of the trillions of ordinary ring particles—the "meter-sized debris"— are responsible for some of the peculiar aspects observed about the SED?

The ready explanation for the enhanced reflectivity of Saturn's rings at the centimeter wavelengths involved both their composition and their average size. The rings' particles, based on this radar observation, were calculated to be "on the order of a few centimeters in diameter." At these same wavelengths, from an experiment whereby VOYAGER actually beamed its own signal through the rings, a much larger average size for ring particles was calculated: meters, not centimeters, in diameter.

The discrepancy could be alleviated if a lot of ring debris is coated with a metal plating—which would dramatically enhance the rings' reflectivity across an enormous span of wavelengths.

Intriguingly, in the two days prior to its first encounter with Saturn in November 1980, as VOYAGER 1 detected the SED emission, it noted two "double humps" in the curve that Evans plotted of number of events against time. That was the only observation in both missions—VOYAGER 1 and VOYAGER 2—where such a peculiar "increase, decrease, followed by increase" in the SED was noted in the "envelope" of 10 hours, 10 minutes.

I have made much of this striking observation in numerous conversations with the Warwick team. I feel that such unique behavior (in terms of all later recordings of the number of events plotted against time) should tell us something. *If* the rings really have some kind of metal coating which dramatically enhances their reflectivity to radio emissions—particularly for those originating *in* the rings—then it appears clear to me that the curious "double hump" in the number of events plotted in those first two days is somehow related to some special property of the rings, and not the source. It is highly significant, I think, that the spacecraft made these two repeating observations of the "double hump" number of events *almost exactly in the ringplane* as it approached the planet during those two days.

At no other time during the flight of VOYAGER 1, or during the second observations of SED on VOYAGER 2, did the spacecraft "hang out" for so long almost in the plane of Saturn's rings.

I am firmly coming to believe that the curious "double-humped" nature of the SED on VOYAGER 1's approach can only be explained as a "reflection effect" across the long pathlength represented by the extreme edges of the rings, from a source of emission located in the middle of the B-ring. And that, in turn,

implies that the ring particles are coated with some kind of metal plating—

Precisely what Romig's model would require.

There is, therefore, a variety of evidence—all of it indirect—that is consistent with a slowly evaporating "drop of solder" in the B-ring, whose vaporized atoms from repeated electrical discharges are "plating out" on all the other ring particles—which were initially composed primarily of ice. This contamination is showing up as a perceptible color for the rings, as well as a spectral set of fingerprints indicating some kind of iron oxide; the presumed result of "x" years of this accumulation from the "thing" itself.

But there is that nagging statistical improbability for the lifetime of the object, which undercuts not only the "contamination" argument, but Warwick's entire "rings-as-a-giant-capacitor" model.

To which I may have a possible solution.

The crucial element in Warwick's latest model is the gap itself—not the object which creates it. If one can find another means to carve a canyon in the rings, as "deep" (the thickness of the rings) as it is broad, then part of the problem disappears. The "capacitor effect," essential to the Warwick spoke model, would then still exist.

What if the PBH creates the gap — through the raw power of its radiation? And the "contamination" is from vaporizing snowballs?

Curious to see if such a thing would work (as opposed to the physical clearing of the gap, or some kind of gravitational perturbations removing ring particles across the hundred meters), I carried out another set of calculations, assuming that some percentage of the observed radiated power—10^9 watts — was absorbed by snowballs all around the "thing." It was hard to imagine icy objects—contaminated with some amount of other stuff, sitting right beside such a display of blazing energy—*not* being somehow affected. Even radio emission, if it's powerful enough, can cause heating. If the snowballs absorbed too much radiation from the "thing," they'd melt—clearing a gap around the object. Releasing junk on other snowballs. Or so I reasoned.

When this computation had been carried out, much to my delight, there was a suspicious correlation between the amount of power SED appears to radiate and the width of the "gaplet" in the B-ring PPS detected!

Even these relatively crude numbers indicated that within a "hundred or so meters of the source" absorption of a mere *ten percent* of this raw energy would effectively vaporize the snowballs. The heating would be roughly equivalent to that experienced by a chunk of ice between Earth and Mars. Intriguingly, it is at this distance from the sun that comets—thought to be merely gigantic "icebergs" in the dark — begin to melt and form their tails.

The picture was beginning to be quite consistent: there was no need to propose a physical object in the gap, separating the two sections of the B-ring; that desired effect (in terms of setting up the large voltage across that gap) could be achieved merely by vaporizing all ob-

jects in the space around the "thing" for a distance of a hundred or so meters (300 to 400 feet). Differential revolution of snowballs and the "thing" around the planet (the snowballs slightly inward of the object moving around Saturn slightly faster than those farther away) should do the rest.

Rich Terrile kindly provided me with the information that the "lap rate," the time it takes for a given snowball in the rings to come around Saturn to coincide with the "thing" once again, is about 2,000 *Earth years!* For despite the fact that both are whirling around the planet at almost 20 miles per second, their *relative* speed—one "above" the other, relative to the center of Saturn—is only a few tenths of an *inch* per second!

For this reason, there has been some debate among the members of the Warwick team whether *any process* which "sees" a particular snowball once a millennium or so could have any durable "clearing effect" within the ring. In other words, when the "thing" is on, let's say, the opposite side of Saturn from a particular snowball in the side of the canyon represented by the gap, which has more effect: the influence of its last passing, or the tidal effects of some of the inner moons—which "lap" the inner rings far more frequently, in a matter of mere hours?

There is a distressing tendency, it seems, for the gap to "fill in" behind the "thing" orbiting Saturn, regardless of the clearing mechanism.

In light of this, it is interesting to note that the PRA team, working in concert with the PPS team, believe they have been able to pin down the period of the "thing" sufficient to resolve the *phase relationship* with regard to both VOYAGER spacecraft. This simply means they think they know where the source of radio emission was relative to both the spacecraft during their respective encounters of the planet. Their "error" they believe to be less than 30 degrees of arc, measured from the center of the planet. ("Plus or minus a few seconds" adds up!)

On the assumption that the peak number of events corresponds to the "thing" being on the side of Saturn closest to the spacecraft, Evans was able to determine where the object should have been the night the PPS scanned the rings from VOYAGER 2. The result of that determination could not be worse or better, in terms of determination of the real existence of a true gap extending all the way around the planet. For it appears that the PPS scanned across the B-ring either *just ahead or just behind* the "thing." (Late information seems to confirm the gap's existence thousands of miles from the "thing," through a *television image* after all, which Evans tracked down! Thus the existence of an annulus all the way around Saturn seems assured.

The maintenance of this "scimitar of Saturn," in the face of overwhelming forces which should fill it in, is the problem. .)

Which brings us to the part of this extraordinary tale perhaps nearer to my heart than any other: that we at last have come upon an object of another kind of search—

The Search for Extraterrestrial Intelligence.

Consider all the evidence:

We have found an object—only *one*—radiating considerable amounts of power. It is located in a most unlikely place for any previously postulated source of radio emission—the rings of Saturn. Its spectrum appears to be absolutely flat across a considerable "window" of the radio spectrum, a detail I shall return to in a moment.

Curiously, every new observation of the source appears to contain *different* information; there is no consistency between any of the observations, except in two regards: the orbit of the object is apparently stable, and the power of each "burst" (pulse?) is also constant.

With regard to power, there is mounting evidence that all the energy observed (and perhaps considerably more) is confined within a volume smaller than an opera house or stadium on Earth. This energy could range from that consumed by a city like New York, to that consumed by an *entire continent!* The main problem for the leading "conventional" explanation of this source is the longevity of such an extraordinarily energetic object, in terms of sheer power density. The best model so far advocated has one enormous drawback: that the object creating the observed radio emission can survive its own energy dissipation "only" for between a million and a hundred million years—mere "slices" against the lifetime of the solar system.

This has led to considerable consternation: the "thing" broadcasts from the rings, yet appears to be within a few million years of vanishing—a situation made all the more acute by the failure of the radio occultation experiment to detect a gap of the dimensions expected for "a 500-million-ton iron moonlet" in the rings.

While "explaining" these peculiarities as a consequence of the special nature of a primordial black hole—both in terms of its "immortality" within the rings (once captured) as well as sheer concentrated power—there are two obvious drawbacks to this proposal:

The fact that PBHs are strictly theoretical; and the fact that the Goldreich theory, if applied in terms of the 300-foot gap the PPS discovered, places an upper limit *smaller* than the smallest PBH that Hawking says currently exists—unless one invokes the special ring environment itself to have kept a smaller one alive!

Which brings us to the possibility which should delight every reader here: that we're dealing with a sample of some kind of extraordinarily advanced technology from someplace else.

An artifact.

Running down the list of remarkable properties the "thing" seems to possess, one is left with two equally unlikely conclusions: that we're dealing with a rare—or possibly unique—natural phenomenon, or that we are seeing evidence of high technology. Not only would these readily explain the radio emission, seemingly impossible power densities, longevity, etc.; they might provide the key to resolving a whole range of other nagging paradoxes brought up by some of VOYAGER's observations of the Saturn system — from the "yin/yang" on Iapetus to the presence of the rings themselves!

What's our "evidence"?

Let's begin with the most obvious: that the SED is inherently *broadband* (which would strongly argue for a natural source).

The equipment aboard the spacecraft is capable of "listening" to the wide range of frequencies we described before—from about 40 megahertz to 20 kilohertz. But, and this is crucial, it is not capable of listening to all those wavelengths *simultaneously*. In the normal "mode" it takes six seconds for the PRA receiver to "sweep" its band — like one of those police scanners tuning down its range. It was the virtually identical appearance of SED in every frequency "bin" sampled in that six seconds which led the Warwick team to conclude that SED broadcasts simultaneously across the band.

The instrument has another mode, the so-called "high-rate" sample. Here, two frequencies 300 kilohertz apart are sampled truly simultaneously; then, a few thousandths of a second later, another pair—several million hertz away — is also sampled. Thus it is *theoretically* possible for a 300-kilohertz-wide signal to be *scanned* rapidly across the PRA receiver's range—

And still *look* like a simultaneous broadband emission!

Warwick, in the *Science* article describing the initial PRA results at Saturn, takes note of this by saying, "Any drifts would have to be faster than 10^4 (ten thousand) megahertz per second, which is three orders of magnitude faster than the fastest drifts in Jupiter's emission."

Thus the conclusion regarding SED as "broadband emission" is not strictly an observational fact but more an inference.

A lightning stroke broadcasts simultaneously over a wide frequency band. A snowflake "swallowed" by a PBH might do the same. But artificial radio transmissions are automatically expected (from terrestrial experience) to concentrate their energy into a *narrow* range of wavelengths. The most efficient way to transmit a lot of information is to pick a frequency (or wavelength), match a transmitter and receiver, and send

But what if the person to whom you're sending doesn't know you're there? Worse, suppose he/she (it?) is completely ignorant about which frequency on which to listen?

That, in the proverbial nutshell, has been the central problem in the off-again, on-again search for signals from some kind of extraterrestrial intelligence across the preceding twenty years: not knowing which band to listen to, out of *millions* of possible frequency regimes.

One answer proposed has been a beacon.

If someone wanted to call attention to themselves, to a species with unknown technology who might be listening on any wavelength, a suggested technique has been to transmit across a vast range of wavelengths *simultaneously*. Thus, whatever band the receivers of the intended message happened to be tuned to would pick up a portion of the signal, appearing as a momentary "pulse" within their "window" of reception.

Such a technique takes immense amounts of power.

An alternative, accomplishing much the same thing, has been suggested: "sweep" the band. Transmit a strong signal on a series of successive wavelengths, sweeping the transmission signal from the lower frequencies to those higher, or the other way around. The point being: the constantly sliding signal will eventually pass through the "window" where your intended listeners are listening, alerting them that something "funny" is occurring in that region of the spectrum. The theory is that, after you've attracted their attention, you can direct them to a narrow-band channel where the real "show" is going on.

All right, let's assume that's what SED emission is: an extremely rapid scan across the spectrum, which VOYAGER picked up as it flew by. If that hypothesis—that we've encountered what is essentially a beacon signal—is correct, it could provide plausible answers to a couple of other "oddities" VOYAGER observed.

During the night of closest approach, VOYAGER 1 monitored a completely altered signal from the SED emission. Over a four-hour period, the "bursts" appeared only at the highest frequencies VOYAGER could hear. During this interval, however, the frequency slowly "scanned" toward the lower ranges of the instrument—a behavior which was *not* repeated during VOYAGER 2, despite a similar geometry with respect to the spacecraft and the rings.

The second "funny thing" which happened during the VOYAGER 1 flyby occurred within hours of the previous behavior: the appearance of polarization in the signal.

For two days the SED had been unpolarized, as VOYAGER fell toward the planet. Only after the previous incident of "frequency scanning," as the spacecraft left by a route which took it far above the ringplane, did the polarization suddenly "pop on."

Let me quote from the 1975 NASA Science Workshop, held at the Ames Research Center, on the subject: The Search for Extraterrestrial Intelligence.

"There is no predicting what polarization schemes another species might employ, except (probably) in the case of signals expected to be received at great interstellar distances by antennas of *unknown rotational orientation* (italics added). . one would expect intentional, long-distance signals to be *circularly polarized* at the point of origin."

Over 95 percent of the SED VOYAGER 1 observed that night as it "fell away from Saturn" was *circularly polarized*—the best possible technical means of ensuring that, no matter what the orientation of antennas on the spacecraft, the signal from the "thing" would be observed!

As long as we're pursuing this, let's examine a plausible scenario.

Whatever "it" is observes VOYAGER approaching, perhaps by radar at a much shorter wavelength (beyond VOYAGER's range of sensitivity), or perhaps a return echo from the "SED" itself. (There are so-called "chirp radars" on Earth which employ the rapid frequency-scanning technique sug-

gested earlier, that could masquerade as broadband SED.)

When VOYAGER doesn't respond to these electronic probings, the source "decides" to switch techniques; a deliberate, slow scan across a probable region of the spectrum is performed in the hopes this intruder will respond. And when that doesn't elicit the desired "communication," one last technique is tried: the switch to circularly polarized emissions, on the theory that the antenna on this unknown "target" (VOYAGER) cannot detect the earlier transmissions.

For a week past the Saturn encounter, as VOYAGER falls farther and farther away with every passing hour, the unknown "transmitter" in the rings vainly sends its signals — circularly polarized — and stepped up in power to compensate for the constantly increasing distance all to no avail.

Science fiction? Sure.

But those are precisely the *facts* of what happened to the SED signal VOYAGER observed. I've only added an "interpretation."

Within the ET paradigm there is even a name for such an object: a Bracewell Probe.

A Bracewell Probe is a robot dispatched to "bug" a likely solar system. Proposed by radio astronomer Ronald Bracewell, one of the purposes of such a device is supposed to be "first contact." The technique Bracewell proposes is this: the robot picks up one of our normal TV or radio transmissions, then "plays back" the identical transmission—with a significant delay. We're supposed to become curious about these unexplained "echoes" and track down the source—at which point the Probe begins its true communication.

It is just as possible that the signals VOYAGER detected as the "thing" are inadvertent, stray radiations produced by some unimaginable technology carrying out some unimaginable purpose on which we serendipitously "eavesdropped" the nights VOYAGER flew by.

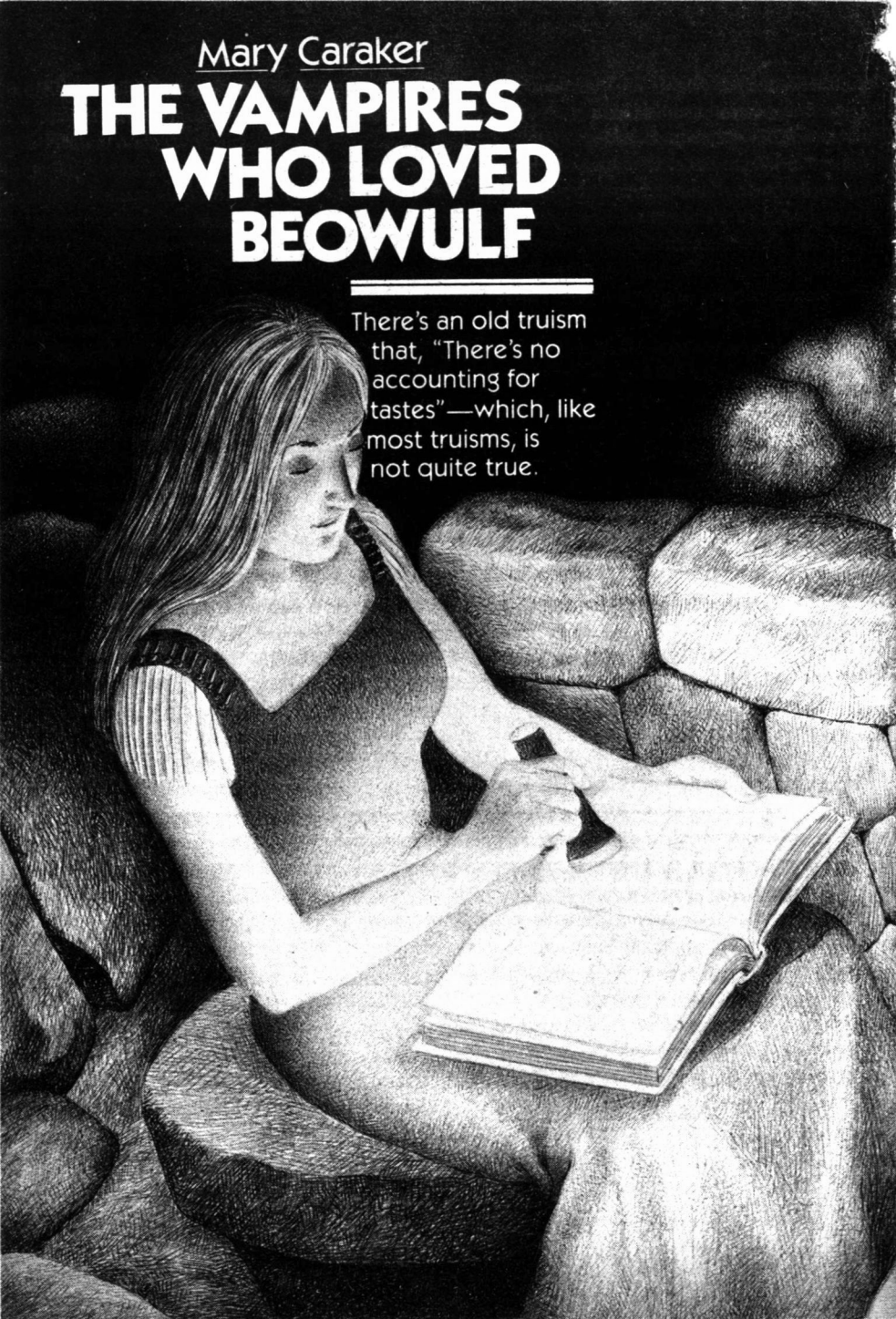
In my unbridled speculations, I can even reason out the one place such an artifact might choose to wait for us, placed so that a culture below a certain minimum technological ability would not inadvertently discover it—

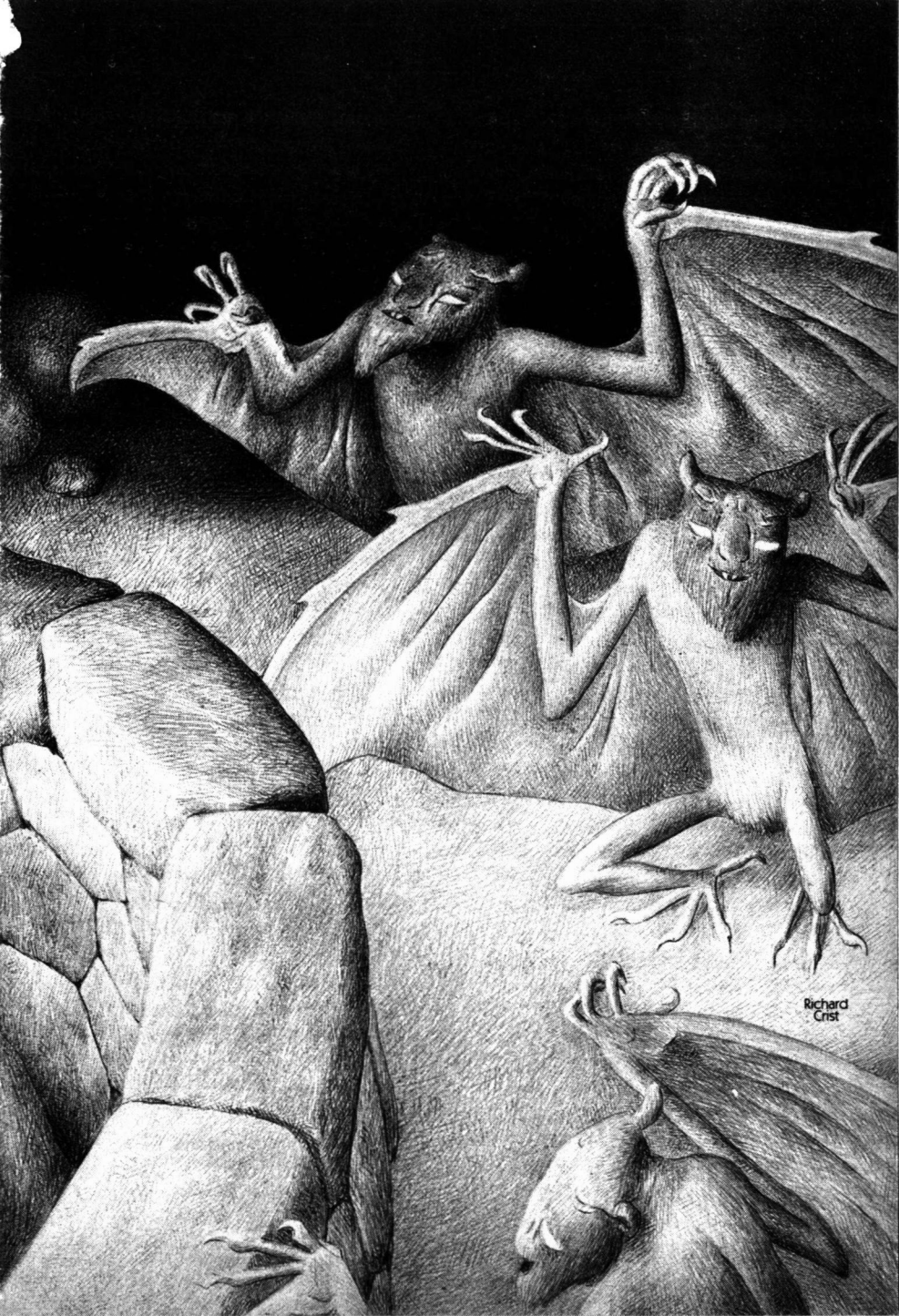
In Saturn's rings.

What better lure those spectacular and splendid rings, gleaming like crystal in the sun as a fervent love for beauty, an abiding curiosity, was evolving closer to that sun, to someday spiral outward to the edges of its system, drawn—as it knew we would be—by the vision of the planet Saturn

As any reader here will recognize, there is an eerie feeling of déjà vu we are describing the same kind of "trip wire" that Arthur Clarke so beautifully described in "The Sentinel," which went on to become "2001." Or is it now to be *2010*, the sequel to Clarke's classic tale, which begins high in the feed of Earth's vast radio telescope at Aricibo as two men discuss a strange radio transmission that has lured an expedition halfway across the solar system to the planet Saturn.

Only this time it will be the Very Large Array and the mystery is absolutely real. ■


Mary Caraker
THE VAMPIRES WHO LOVED BEOWULF
There's an old truism that, "There's no accounting for tastes"—which, like most truisms, is not quite true.


Richard
Crist

"Morgan Farraday!" A shout pierced the noise and bustle of off-loading. At the terminal entrance a gaunt, past-middle-aged woman with short-cropped gray hair waved and beckoned.

Morgan hoisted her duffle and threaded her way around the containers and the knots of sweaty workers, trying to swallow her irritation. Appreciative comments followed the trim figure, but Morgan did not respond. Dr. Wheeler was two hours late, and the Lagos Port terminal was cold and drafty.

Not that she'd expected a big welcome. This was Roga, the dark planet. The vampire planet. The scrapings of the barrel, as far as Space Corps teaching posts were concerned. Morgan considered that she had every right to feel chagrined, especially after her triumph on Parth. On that planet Captain Kraskolin had had her instructing the other teachers, and here she wasn't even to be in charge of her own class. She was to be an assistant, as if she were a raw neophyte, or someone who hadn't made the grade on her own.

And if the posting had been a disappointment, so was the assignment —teaching epic poetry to bat-creatures who couldn't even talk!

It wasn't Dr. Wheeler's fault, though, and Morgan had determined to keep an open mind about the *Alien Studies* author-anthropologist. But being kept waiting was a poor start, and when her new boss beckoned again, peremptorily, Morgan's irritation increased. However, she obediently quickened her pace.

"I'm Sarah Wheeler." A work-roughened hand gripped Morgan's, then propelled her hastily out of the terminal to an airsled parked on an edge of the rocket field. "Sorry for the delay. Minor emergency at the station—have to hot-foot it right back. No time to show you around town. Maybe later on. As you can see, there's not much here anyway."

She was right. It was a barebones port, with no frills. They were quickly airborne, Dr. Wheeler skillfully maneuvering over the block-like buildings as she talked in staccato bursts. "Glad to have you here, Farraday. You come highly recommended. Surprised, though. I expected someone . older. But we'll see. Bit of an adjustment, in any case. Roga's not at all like Parth, you know."

"I know—I've heard the tapes." The airsled took on altitude as they passed over open country—flat dusty plains, low mountains in the distance dark under the glowering sky whose heavy gray clouds never parted.

A cluster of rounded earth-covered roofs marked a Rogan underground settlement. It appeared deserted. "The Rogans don't like light even this dim?" Morgan asked. "They're all sleeping now?"

"That's right. I'm afraid you'll have to become a night-owl too. No other way to teach them. At the station, you'll be on their time."

Strong winds buffeted the airsled, and Dr. Wheeler fought to keep it steady. They flew over more shadowy plains interspersed with what appeared to be marshes, and Morgan held on to her seat as they bounced roughly. Another underground city thrust upward like a long molehill.

They were almost to the mountains, which were higher now than they had

seemed from a distance: purple cliffs hollowed by the wind. A single blinking signal light announced the approach to the Terran station-school.

The airsled banked steeply and descended to a feather-light landing. Dr. Wheeler was out in seconds, around to Morgan's side and unloading her gear. "That building straight ahead is our quarters. Sorry I can't get you squared away, but you'll find everything you need. The room on the left is yours. Expect you still feel rocky after entry, so why don't you rest?"

She unsnapped a key from a heavy ring. "Bolt the door after you. I'll be at the other building until dark. Hospital case."

She was gone, hurrying with great strides toward the smaller bubble-hut that squatted in the gloom of the overhanging cliff.

The station was sheltered, and the wind whistled harmlessly from beyond the bluff. Still, Morgan shivered. She unlocked the padlocked door and bolted it from the inside, disturbed by the tight security. Perhaps, she thought, the rumors about the Rogans were true.

Morgan's room was spartanly furnished with a cot and worktable, but both were buried under a mass of papers, books, tapes, files, and even cartons of old clothing. Grimly she piled dusty boxes on the floor to make space for her own belongings. She knew that she was replacing Dr. Wheeler's husband, but he had been dead for six months and there would have been plenty of time to clear away his things.

Unpacked, she rummaged in the kitchen for a snack and then stretched out on the cot. She *was* tired, and in the gray light it was easy to pretend that it was evening.

When she awoke it was dark. Someone was pounding at the door, and she groggily stumbled up to let in Dr. Wheeler.

"You've slept? Good for you—I could tell you needed it." The gray-haired woman lighted lamps and the stove and filled the coffee pot. "Let's have breakfast. No—let me do it; I know where everything is."

She efficiently opened packets and heated and stirred, and had a hot breakfast on the table in minutes. When she sat down, though, Morgan could see the strain of an all-night vigil in her face.

"How is the patient?" Morgan asked. "And *who* is it? I thought we were alone here."

"It's a Rogan. One of my helpers. He met with an . accident doing some field work for me. At the moment, there's a lot of unrest among the natives."

Dr. Wheeler stirred her plate of eggs, then looked up at Morgan with a worried frown. "I've been thinking about you, Farraday, and I hope you won't take it wrong if I suggest that you don't have to stay. You can catch the rocket out tomorrow. It's either that or be stuck here until the next one comes. I can get along alone; been doing it for six months."

Take it wrong! How else could she take it? Morgan choked on her coffee and sputtered. "Of course I'm staying," she finally said. "How would it look if I refused an assignment? Or are you refusing me?"

Dr. Wheeler stared at her hands. "No, I didn't mean that. It's just

that—all right, I've never been one to mince words. This is a tough post, and I was hoping for someone with more experience."

She silenced Morgan's protest. "Oh, I know all about your brilliant success on Parth, teaching language. But we use the voder here, and I'm afraid the Rogans are a different matter entirely."

Morgan stifled her anger. She definitely was not leaving, but all the same she couldn't help wondering just what it was she would have to face. "Are they really vampires?" she asked.

"I thought you said you'd been briefed," Dr. Wheeler said drily.

"Of course I have." Morgan sat up very straight. "I just thought you could give me your personal observations. Or are your studies classified?"

"Not at all. But don't look to me to contradict the tapes. They're true. Yes, the Rogans are bloodsuckers." She said it matter-of-factly, as if she had said that they preferred bananas. "Greedy bastards, too. Several liters at a time. They feed twice a week."

Morgan tried to hide the effect of Dr. Wheeler's words. "But they have their own *jouk*-herds, don't they? What I mean is, they aren't dangerous to us."

Dr. Wheeler frowned. "What was on those tapes, anyway?"

"Nothing about their eating habits. It was mostly about their homes and cities and ranches—as much as we know, which is very little. And of course about their songs, since that's going to be my job."

The anthropologist snorted with disgust. "I should have guessed—don't give the sweet young things nightmares!" She looked at Morgan levelly. "Well, you'd better know now. Yes, they are definitely dangerous. If you provoke them, they'll suck you dry. And I mean *dead*, with no nonsense about transmogrification."

Morgan gasped. "I didn't know they drank human blood!"

"We didn't, either, but that's the way Nate died. My late husband." She paused, as Morgan sat in shocked silence, then tempered her revelation. "It was his own fault, though. A freak occurrence, and not something that's likely to happen again."

She seemed very sure. "How do you know?" Morgan asked.

"One of the Rogans confessed. He was an aberrant, and they've taken care of him in their own way. And, as I said, it only happened because Nate was careless. Still, I had a devil of a time persuading the Corps to keep this station open, and only by swearing to be responsible for you. Now, are you still sure you want to stay?"

Morgan nodded, though she had to clasp her hands to keep them steady.

Dr. Wheeler arose. "Then you might as well meet your first pupils." She unbolted the door and Morgan, close behind her, peered into the darkness at the black shapes huddled in a formless mass against the wall.

"They won't come inside unless you turn out the lights. But wait a minute — there's Far-darter, and maybe she'll come in to meet you. She's braver than most. Let me get the voder."

Dr. Wheeler returned with the voice coder and spoke into it. "This woman is your new teacher. Singer. She wants to see Far-darter inside. Please."

The voder transcribed the words into

high-pitched squeaks, and a small dark figure detached itself from the others.

Inside, Morgan studied the female Rogan who crouched in the doorway. She was no more than a meter tall, with black leathery skin hanging loosely on a thin frame, generally humanoid in shape except for the webbed arms and clawed hands. The eyes in her bat-face were screwed tightly shut, but Morgan knew that they were red, as blood-red as the cruel small open mouth with the sharp protruding fangs.

The Rogan spoke into the voder—a thin, piercing wail that hurt Morgan's ears—and the translation issued in clipped impersonal computer tones. "Welcome, teacher. Now we learn more Earth songs. Happiness. We are ready, friends and myself."

"Does she mean *now?*" Morgan turned in consternation to Dr. Wheeler. Surely she wasn't expected to begin so soon.

Dr. Wheeler suppressed a faint smile. "No, I'll send them away. Give you a few hours to prepare. They're eager, you must understand. It's been six months, and they were well into *Beowulf*.

"Come back midday," she said into the voder, and led Far-darter out.

She looked at Morgan appraisingly. "Not exactly appealing, are they? Want to change your mind?"

"No, I don't mind the way they look," Morgan lied. "And I don't intend to provoke them." She struggled to sound composed, when in reality the sight of Far-darter had affected her most unpleasantly. "I'm much more concerned about having to use a voder to teach literature. Epic poetry—that's really all they're interested in?"

"Nothing else. Nate tried to slip in some history and a little science, but they detected it and boycotted him. Took him months to get them back. You know the Corps rule—teach them only what they ask for."

"I know, but poetry must come out sounding rather peculiar. And the vocabulary—is it adequate?"

"Nate did a new coding for every epic. The *Iliad*, *Odyssey*, *Aeneid*. His voder is still keyed in for the *Beowulf*, so you won't have to do it. Here, I'll get you all his files. No reason why you can't continue where he left off—unless of course you want to start off new with *Roland* or *Morte d'Arthur* and a whole new vocabulary."

"No—no," Morgan said hastily, "*Beowulf* is fine. I'm no literary scholar, and no voder expert, either." Dr. Wheeler had dumped a jumbled box of tapes and papers on the table, and Morgan began to sort through them.

Dr. Wheeler sat beside her. "Let me help. You have four hours before class, and I can show you what Nate was doing. His techniques, anyway—I'm not familiar with the material. All that was his department."

Dr. Wheeler seemed to have accepted Morgan, albeit grudgingly. They plowed their way through Nate's texts and notes until Morgan had a fair idea of what he had done and how she should continue.

She was impressed by Nate's scholarship. He could have worked from a modern translation, but he had made his own from the original Anglo-Saxon—just as he had done with the Greek and Latin

epics. And for an audience that would neither know nor care.

Nor had his wife, apparently. Sarah Wheeler checked the voder memory banks for any new words, but the content she left entirely to Morgan. Fortunately, Nate had translated far ahead and it sounded good—Morgan didn't try to change it.

By lunch the two women were on a first-name basis—not exactly friendly, but a working relationship. Sarah had made it clear that she had her own research to pursue and couldn't be bothered with the teaching. Morgan would be in complete control there, and her pride was somewhat soothed.

Morgan heated soup while Sarah checked on her patient. She was back shortly. "He's gone," she said. "Damn it!—but I'm not surprised.

"They hate our surroundings," she explained. "He's far from well, but he'll probably heal better at home."

Morgan served. "What was wrong with him?" she asked.

Sarah was evasive. "A a hunting accident," she said. "Lost an arm. Nasty wound, but I did what I could for him."

Morgan pressed. "I thought it was some sort of trouble among the Rogans. 'Native unrest,' you said."

"Did I?" Sarah's weathered face became a mask. "Yes, they have their wars. We can't interfere. Whatever you do, don't try to get close to them. All I do is compile facts, and all you do is teach them poetry. We keep our noses clean and we're safe. Otherwise—you know what happened to Nate. He made the mistake of trusting a Rogan."

"But Nate's murderer was crazy, wasn't he? The others ."

"Keep your distance with all of them!" Sarah snapped.

After a strained moment she offered a half-apology. "If I've frightened you, it's so you'll be prepared. You'll be all right as long as you don't overstep—but be sure to load your finger-needle. If you like, I'll stay with you this first time, just to help you get started."

Morgan was more than glad to accept the offer, and after lunch the two women packed up the voder and the notes and a couple of folding chairs.

Nate had held his classes outside, for the ease of the Rogans. Sarah led the way, surefooted in the darkness with only a thin beam of light.

Behind the station they climbed a stony rise that ended just under the cliffs. A rough basin-like amphitheater was already filled with the indistinct shapes of Rogans. Their shrill cries ceased abruptly as Morgan and Sarah came into view.

Someone had constructed a partially enclosed platform against the rock wall. "Nate used to recite from here," Sarah said, placing Morgan's voder on a large flat stone and her book and notes on another. "If you need to read you can shine a beam down here, without bothering them too much. Better not to, though. Nate always spoke from memory."

"I will, too," Morgan said. Sarah shut off her light, and in darkness Morgan unfolded her stool and faced the ranks of glowing red eyes.

These were adults, she knew, not the ingenuous children she had dealt with on Parth. They were, in fact, the elite

of the clans, the singers: the repositories of Rogan myth-history, of the epic songs that were their art and music and literature. Morgan sensed their excitement as they waited for the new treasures that she would bring.

Nate Wheeler had made a spare, rhythmic translation which attempted to preserve the strong beats of the Old English line. It was the section in which Grendel's mother appeared:

"To avenge her son
"She came then to Heorot,
"Where the Ring-Danes
"Slept in the hall."

The Rogans listened raptly as Morgan described the battle in the hall and the escape of the monster to the fenlands. She had memorized what she thought was a long enough passage, but even pausing after each line for the voder to translate, she was finished far too soon for her avid audience. They stirred and wailed, and Sarah whispered for her to continue.

She would have to read. Morgan switched on her beamer, and after a momentary flurry the Rogans settled down. She started with the description of the demons' lair:

"They that secret land
"Inhabit, retreat of wolves,
"Windy headlands,
"Dangerous fen-path,
"Where the mountain stream
"Under the misty cliffs
"Flows downward."

Morgan shivered, caught in the spell of the words. The gleaming eyes and dark shapes around her seemed transported, too. As she read on they began to sway almost hypnotically with the beat. It was a gruesome passage in which Beowulf accepted the new challenge, rode to the bloody pool, and found the severed head of the murdered thane.

Morgan stopped when her throat became raspy. "End for today," she announced. The chorus of answering squeaks sounded alarmingly like protests.

A wave of dark forms approached the stone podium, and Morgan rubbed her needle release uneasily. "Are they angry?" she whispered to Sarah.

But before Sarah could answer, a ghastly red mouth squeaked into the voder. "Beautiful. Happiness. Many thanks," the machine voice translated.

One after another the singers expressed their delight and appreciation, then lifted their webbed arms and skittered off into the darkness.

"I'd say you were a success," Sarah said, helping Morgan pack up. "Feel better about it now?"

Morgan delayed answering until they were well down the slope. She had perplexing thoughts. "It went all right, I guess," she finally said. "An enthusiastic audience certainly helps. But you know, it wasn't really *teaching*. I could have been a robot out there—or even a tape recorder. Why does the Corps waste a trained teacher on something like this? Wouldn't it be more efficient to code the epics into Rogan speech and just give them the tapes?"

"Won't work," Sarah said. "The Rogans insist on a live teacher. It's their way. We tried the tapes, but they refused them. Insulted. Their singers have incredible memories, you know. Every word you said today they'll remember forever."

"And repeat it at their own songfests? Have you been to any?"

"No. Unfortunately, that's out of bounds for us."

They were back at the house and Sarah made coffee. "So you've never heard the Rogan epics?" Morgan asked.

"Nate did. Some portion, anyway, from Far-darter. But she spoke much too fast for the voder, and all he got was a jumble about journeys and battles. He was trying to do a translation—it's somewhere in that mess he left. I've been too busy to go through it, I'm so far behind schedule with my own work."

Sarah's face settled into tired lines of discouragement. "The Corps is going to pull me out, you know, unless I produce a Rogan book soon. And in three years I haven't gathered enough information to fill a chapter."

"Because it's so dangerous to approach them?"

"Yes—that, of course. But what also makes it difficult for me is that they seem to have no sort of public lives. I've never studied sentients who were so reclusive. And since I can't get into their cities—wouldn't go alone, anyway—I've had to reconstruct from nothing but old bones and deserted settlements. Hardly the definitive study the Corps wants."

"What is it you're working on now?" Morgan felt almost at ease with this more human Sarah who could confide her own difficulties.

Sarah brightened. "On a ruined city I found just last month. Great luck—been going out there every day."

"When are you going again? Can I go along?"

Sarah frowned. The prickly shield was up again. "Frankly, I don't think you'll have time for sightseeing."

"But I won't be teaching eight hours a day."

Sarah gave her a look that shrivelled any new hopes of intimacy. "I'm afraid you still don't understand the situation here. It may not be your idea of teaching, but it's no sinecure. When you finish the *Beowulf* and run out of Nate's translations, what then? You'd better have something ready—those Rogan singers won't want to be kept waiting.

"You'll find that you'll earn your credits at this post," she said crisply, getting up from the table. "We both will. And I for one can't be bothered with tourists." She started for her room. "I'll be off to the site as soon as it gets light, and you'll be sleeping. I'm going to bed now, and I suggest you get to work. Nate and I both found that there weren't enough hours in the day for all we had to do."

She closed her door and Morgan was left fuming, with burning cheeks. So Sarah Wheeler considered her a lazy dilettante, did she? An incompetent, compared to Nate. A nuisance who couldn't be allowed near her precious site.

Her first instincts about the woman had been correct. She was an anachronism—a dusty research machine with no humanity. Morgan had glanced through the two dull tomes that had established her reputation. Facts, statistics, measurements. Meticulous analysis, but with no feeling for the aliens she so painstakingly catalogued. No wonder she had been unable to establish any rapport with the Rogans. No wonder she had to study only dead cities.

Morgan glared at the closed door. Dr. Wheeler apparently wanted to see as little of her as possible—they would even have different shifts. In fairness, she admitted that the anthropologist needed light for her explorations while the teacher had to catch her students awake. But still—it was a good arrangement for two people who disliked one another.

At least, Morgan vowed, she would give Sarah no grounds to fault her half of the partnership. She washed the dishes from breakfast and lunch and sat down with her books.

She soon found that Sarah had been closer to the mark than she knew; preparing the next passage was no snap. Nate's translation ran out and Morgan sweated over an Anglo-Saxon dictionary and the battle with Grendel's mother until first light.

Sarah emerged from her room in full field gear. "I'm taking the airsled," she said. "You'll be safe here, but bolt the doors."

Morgan nodded and tried not to appear envious. Was she to see nothing of the planet?

Sarah unbent. "Maybe you can come tomorrow, if you aren't too tired." She took in the clean sink and the piled worktable and registered approval. "You'll be here a long time."

At the moment it was small comfort to Morgan. She slept, and awoke to darkness and another performance under the cliff.

"Then was by the hair
"Carried into the court
"Grendel's head,
"Where men were drinking,
"Terrible to men.
"And the woman's also
"Wonderful spectacle
"Men looked on."

Morgan finished, stiff and dry-throated after two hours of recitation and reading. The Rogan singers had listened as intently as before, and again responded with high-pitched squeals of thanks. They began their exodus down the rubbly slope, excited and purposeful, and Morgan watched with wondering curiosity. Where were they going? Back to their burrows, to sing their own songs? To their *jouk*-herd farms? No public lives, Sarah had said. And their private lives shrouded in secrecy.

It was shameful, she thought, to know so little of them. To be so distant. She remembered Sarah's warning, but she also remembered her experience on Parth, where she had succeeded with the natives only when she had broken through her own prejudices. Sarah obviously hated the Rogans, after Nate's tragedy. But was she being fair?

She would have to make her own decision, Morgan thought. She detained one of the Rogans who was still squeaking thanks into the voder. The creature drew back, trembling, as Morgan touched the clawed hand. "Where do you go now?" she asked. "Can you stay to talk with me?"

The Rogan blinked and uttered a piercing wail. Morgan jumped, but just as she had stationed herself safely behind the podium another Rogan came flapping up and the frightened one disappeared.

"Far-darter," said the new arrival into the voder, identifying herself. "Talk,

yes. All singers go home now. You like to come see?"

Morgan shrank from the glowing red eyes. But she was tempted. Sarah, with her stand-offish attitude, had never been invited into a live city. What a coup it would be to beat the supercilious doctor on her own grounds!

"Talk first," Morgan said, hedging. She moved aside so Far-darter could share her platform. She placed the voder between them. No harm, she told herself, could come from a simple conversation. "Which Terran songs do Rogans like most?" she asked.

"Beo-wulf," came the voice from the voder. Far-darter shifted uncomfortably in the narrow space. She raised her arms and the hanging skin flapped. "Come *now*. You like to come now?" she repeated.

Morgan ignored the Rogan's impatience. "You have children, Far-darter?" she asked. "You have husband—mate? Teacher would like to know about Far-darter. Be friends."

The Rogan grew even more agitated and uttered shrieks that the voder could not translate. She finally calmed. "Friends, yes. Teacher, Far-darter, friends. Teacher like to see Far-darter home? See song-hall?"

"Mor-gan!" A shout interrupted the conversation, and Far-darter cowered beneath the podium as Sarah approached with a light.

"Do not be afraid," Morgan said, silently cursing Sarah. "Doctor friend too."

Sarah switched off the light at Morgan's frantic pantomime, but not before Morgan had seen her grim face. The doctor arrived panting.

"Far-darter has invited me to visit their city," Morgan said, not bothering to disguise the triumph in her tone. "Maybe she'll let you come too."

"Maybe you'd better have your head examined," Sarah said. She pulled Morgan roughly out of the enclosure. "You're all right?"

"Of course I am." Morgan struggled free. "Did you hear what I said? A chance to visit—"

"I heard. Yes, it's fine. Good. But let me handle it." She spoke into the voder. "Much thanks, Far-darter. Doctor, teacher visit soon. Tomorrow. With Lagos Port men. Two. Is good?"

"Is good." Far-darter edged out of the enclosure. She raised her arms and started down the slope.

"Thank you, Far-darter. Friend. Goodbye," Morgan called after her. Then she turned angrily to Sarah. "Was it necessary for you to come barging in like that? We were just getting acquainted, and now you've frightened her off. I thought the class was supposed to be *my* province!"

"I was worried when you didn't return," Sarah said stiffly. They walked down the slope in silence, but Sarah registered disapproval with every motion of her rigid body. As soon as they entered the house she exploded.

"You don't listen, do you? I'll say it once more, and for your own good you'd better pay attention this time: in this post we aren't good will ambassadors. Between our species, that would be impossible—I've told you why. We need the base here, and they seem to need our stories. Strictly business, that's what it has to be."

"Are you so sure?" Morgan was fed

up with Sarah's lectures. "Have you even *tried* to see the Rogans as creatures who have feelings, too? Maybe if they thought of us as friends "

"Rubbish!" Sarah spat out rudely. "You seem to have become an expert rather quickly. And without much information." Her tone was icy. "Perhaps I should have told you more about Nate's death. He made the same mistake as you—tried to get close to them. Tried to be friends. Yes, Nate was a true humanitarian. Would you like to know how he looked when I found him?"

Confusion gripped Morgan. "I . I don't think so."

"Wise. Since you can't avoid a certain amount of contact with them. But you *can* keep it to a minimum. And with safeguards. No solitary tete-a-tetes, no unscheduled visits to their homes. That's madness." Sarah sighed heavily. "As soon as I met you I was afraid of this."

"Afraid?"

"Yes. Of a know-it-all kid who wouldn't take directions." With that parting shot she stomped off to her room.

Sarah remained behind her closed door, and Morgan warred between embarrassment and defensive anger. After a while she tried to find relief by working on translations. She would finish the *Beowulf* in a few days, and had decided to attempt the *Kalevala* next. Nate had made a start on the Finnish epic, and it seemed like something that would appeal to the Rogans.

She thought about Nate Wheeler as she followed his careful scholarship, admiring the way he made the lines sing. He was something of a poet himself. A poet who had wanted to reach out to the Rogans beyond words, and had died for it.

Nate and Sarah. She tried to imagine them together—an unlikely couple, if ever there were one. Each must have been buried in his own world. Sarah knew nothing about the poems. "All that was his department," she had said in a tone of amused condescension. "That mess he left," she had called his overflowing files. "A humanitarian," she had said with bitterness. Her own desk and shelves were immaculate and no one—human or alien—would ever pierce her iron guard.

But Sarah had been right. Nate was dead, and the flutter-headed young assistant had deserved her rebuke. Morgan was ashamed, though it didn't make her like Sarah any better. But something would have to give if they were to continue working together, and Morgan was prepared to do her part even if it meant eating humble pie.

Sarah had apparently done some thinking, too. When she joined Morgan for dinner/breakfast she was studiedly pleasant. "I'll take you out to the digs with me today," she offered, and Morgan just as civilly accepted.

They continued a restrained politeness during the flight, and at the ruined city Sarah's press of work and Morgan's absorbed interest pushed the remaining tension into a temporary limbo.

Two strong backs from Lagos Port named Nels and Ed and a crippled one-eyed Rogan comprised Sarah's crew. The men were excavating the blocked tunnels while Sarah, with her Rogan guide, attempted to reconstruct the life

that had once flourished in the underground complex.

Morgan followed them into stuffy black holes choked with rubble that had been family quarters. In a larger cave floor markings were revealed as the men dug out a layer of dirt. Sarah was busy everywhere with camera and recorder, and with her voder pumping the sorry-looking Rogan.

He gave her very little information. "Song room," he said of the large cave, but would not elaborate on the ceremonies. "Sleeping place," he said of the smaller ones, but turned silent when Sarah questioned him about the details of family life.

"If I believed him, I'd have to conclude that the Rogans did nothing here but sleep and listen to the singers," Sarah complained.

"And fight wars," Morgan added. "Isn't that how this city was destroyed?"

"Yes, and our friend there, Twisted Foot, was one of the casualties. He says the last battle was only two years ago. Go up and look at the wall—or what's left of it. It's interesting; no other Rogan city has a fortification like it. And it's comparatively recent—much newer than the rest of the city."

Morgan climbed gratefully out of the dark burrow into the gray light. She studied the levelled wall. It circled the underground city, but judging from the remnants it could never have been high enough to offer more than token protection. Two meters at the most. Hardly a high-walled Ilium, she thought, but still the comparison stuck. And the Rogans *were* familiar with the classical epics.

Sarah joined her on the wall, along with the workmen from Lagos. They ate a picnic lunch, and Sarah bribed the men into accompanying them that evening on Far-darter's promised tour of a live city. They were both reluctant, and she had to pledge a month's credits before they agreed.

Twisted Foot remained underground, afraid of the light. "Will he talk about the war?" Morgan asked.

"Not a word," Sarah said. "Apparently he was ostrasized because of it. He was left for dead, but when he recovered he couldn't get back into the clan. Seems that his own people were responsible for the loss of his eye."

Morgan was electrified by a far-fetched idea, and ran to the tunnel entrance. The Rogan was curled up asleep just inside.

"Fleet-foot!" she called into the voder. It was the name Nate had used for Achilles.

The Rogan was instantly awake, squealing and cowering against the wall. Morgan remembered Nate's translation of Polyphemus, the Cyclops. "Giant One-eye. That is you, too," she said.

The Rogan's terror seemed to confirm it.

A theory was beginning to take form. Too nebulous yet to tell Sarah, but definitely something to investigate.

The men, Ed and Nels, wanted to return to Lagos Port for additional weapons before embarking on the evening expedition. Sarah agreed, and they cut short the work day. They were to meet at the station that night after the lesson.

Sarah landed the airsled two kilo-

meters from the Rogan city and they hiked in. Fortunately the wind was at their backs. Far-darter led, skimming lightly over the ground with bat-arms raised. The humans had to trot to keep up, the heavy-bodied men with curses and labored breaths. They passed a fenced-in field, and Sarah shone her beamer on a dark form fastened to the hump of a bellowing *jouk*.

Far-darter swooped back, shrieking, and Sarah shut off her light. They walked in darkness in a tight group. All were armed and Nels had a radio beamed to Lagos Port, but still Morgan felt frighteningly vulnerable.

Inside the city it was worse: close and stuffy and claustrophobic with the sense of too many bodies crowded into too small a space. The complex seemed to be filled with activity, but Morgan could see very little, even with the dim light that Far-darter permitted. The Rogan led them through a warren of passages that opened into cavelike rooms packed with dark forms. In the tunnels, streams of Rogans skittered past them, and shrill cries echoed from the walls and assaulted Morgan's eardrums until her head throbbed in pain.

Far-darter led them into a large central room, mercifully quiet and empty except for a few workers who were laying stones in a corner of the rough floor. Sarah moved at once to watch them, but Far-darter pulled insistently at Morgan and she followed to an opposite wall.

The Rogan squeaked and fluttered and pointed upward, and Morgan held out the voder.

"Up! Look up. See," Far-darter said, and Morgan shone her beam high on the wall.

A withered black arm hung suspended from a frame.

Far-darter danced with excitement and shrieked into the voder:

"The hand. The arm

"There was together

"Grendel's grasp

"Under the high roof."

Far-darter looked up at Morgan expectantly, but when Morgan only stared at her in increasingly comprehending horror, she backed off.

Morgan ran to Sarah. "I think we'd better go," she said.

Sarah was absorbed with her camera and waved her away. Nels, though, had been receiving from Lagos Port, and the message galvanized him to action. He pulled at Sarah roughly. "We're getting out of here *now*. I'll explain later."

Far-darter led them out, looking back at Morgan and fluttering and squeaking in what was either consternation or scolding—the voder could not translate it for all the other noise. She left them outside and it was Sarah, not Morgan, who thanked her. Morgan was still trying to assemble her racing thoughts.

"There's been trouble at Lagos," Nels said as they fought their way against the wind back to the airsled. "A man killed. Work of the Rogans, for sure."

He didn't reveal the details until they were safe in the air. "Beheaded. Hacked off. And the head is missing."

Sarah swore, but Morgan wasn't surprised. Her theory was rapidly becoming fact. "Look in the marshes," she said. "Chances are you'll find a bloody pool. If the head isn't there, it'll turn up soon in Heorot."

"Heorot? What are you talking

about?'' Sarah looked at Morgan as if she were a candidate for a straitjacket.

''The Rogan's Heorot—that big room we were just in. I'll explain it all when we get to the station—I'll need my notes.''

''Listen to this description of Grendel's hand,'' Morgan said. She sat at a table spread with Nate's annotated translations.

''In front of each (finger) was
''Instead of nails
''Most like steel
''The heathen's hand-spurs.''

''Sure, it could be a description of a Rogan's clawed hand,'' Sarah agreed, ''but what are you leading up to?''

''To the fact that the Rogans *act out* their epics. They're a degenerated race, and their own history is probably a constant repetition of their songs. You were right, Sarah, when you guessed that they do little but sleep and sing. Add to that—re-create.''

Sarah nodded thoughtfully. ''No life patterns that I could catalogue.''

''Because they have none. They're actors. Imitators. Imagine their delight at getting some new material from us. The *Iliad*. The *Odyssey*. Plenty of bloody action there, and I'm sure they performed it all.''

''And we thought it was just tribal wars!''

''No reason for you to suspect otherwise,'' Morgan said, ''since the Rogans took all the rôles. But the *Beowulf*—that was different. No wonder they loved it—to them, Grendel was clearly a Rogan.

''Unfortunately for us, though, the *Beowulf* had too many rôles for humans. You didn't tell me exactly how Nate died, but was it anything like this?

''He quickly seized
''The first time
''A sleeping warrior
''Slit without warning
''Bit his bones,
''Drank blood from his veins,
''Swallowed huge pieces

Sarah's face was set and white. ''Yes,'' she breathed, ''that was it exactly.''

''I thought so,'' Morgan said. ''Nate made a notation here, by that passage. 'Tremendous excitement.' Apparently too much for them to contain.''

''Then—that 'confession' was just a ruse. They were acting out the poem when they killed him?''

''Yes, and they still are. Because they feel such an affinity to the *Beowulf*, they can't even wait until it's finished. I read about the murdered thane at my first session, remember? And they've already done that scene—head and all.''

Sarah was speechless for a long minute. ''Then what else do we have to look forward to?'' she finally asked. ''What other gruesome material have you fed them?''

''Too much. But luckily, passages that only concern violence to Grendel's mother, whom they see as one of themselves. So the next headless body should be a Rogan. Maybe the poor wretch who played Grendel and lost his arm, if he's still alive. Or Twisted Foot, who seems to get the bad rôles, too.''

''God, I hope you're right. But what about later? We can't stop giving them epics; there's our contract.''

''Oh, I'll continue, but I'm certainly going to change my type of material.

Not the *Kalevala*, or any more primitive sagas. No, the Rogans will have to go in a new direction, and it's something Corps Central will have to decide. I don't want the responsibility of guiding their future."

"It certainly opens up all sorts of possibilities," Sarah agreed. "And you're right—it's no longer a simple literary problem. We'll get a message off from Lagos in the morning. But until we hear, what will you do for the next classes?"

Morgan had already thought about it. "I'll end *Beowulf* quickly: an edited version. Then I'll give them something innocuous. *Hiawatha*, maybe—just the pastoral parts. They might even learn to smoke peace-pipes."

"That sounds safe enough." The tension was gone from Sarah's face. "At least, we won't have to send for a rescue rocket."

"No, we should both be able to finish our work."

Sarah looked her question, and Morgan continued: "Your book, I mean. Thanks to Nate, you'll find a wealth of material if we can finish translating those Rogan epics."

"Well." Dr. Wheeler had no more words. Her thoughts, however, were plain. She drew squares on the tablecover with her finger, then lifted her gaze to a spot somewhere beyond Morgan's left ear. The color came and went in her face. "Morgan, I " She cleared her throat.

"Don't say it." Morgan couldn't allow Sarah to humble herself. She continued quickly: "You didn't misjudge me. I *was* a know-it-all, and if you hadn't rescued me from Far-darter that time, the murdered thane would probably have been *me*."

The thought, added to the stress of the last hours, caused Morgan to shudder. Sarah covered the trembling hand with her own. An inconsequential gesture for anyone else, but coming from the doctor it touched Morgan profoundly. Perhaps, she thought, the year would not be entirely without the comfort of friendship. ■

● Would beings from another world covet our gold or other rare substances? Do they want us as cattle or as slaves? Hardly, considering the astronomical cost of transport between solar systems. Any civilization able to cover interstellar distances would hardly need us for food or raw material, which they could far more easily synthesize at home. The most interesting item to be transferred from star to star is information, and this can be done by radio.

Ronald N. Bracewell

The Alternate View

DEPARTMENT OF LONG-RANGE PLANNING

Jerry Pournelle

Last weekend was the Western Regional Science Fiction Convention, better known as Westercon, which is almost always held around a weekend that includes the Fourth of July. (Yeah, I know, the *Analog* pipeline is pretty long.) This year Westercon was in Phoenix, and despite my misgivings about going to the desert in July, I'd already promised I'd be on panels and such well before they scheduled the fourth shuttle landing for Independence Day.

Thus I missed both the landing and the president's speech. Turns out I didn't miss much: both were routine, which is a classic case of good news and bad news. My son Alex went to the landing, and reports that the crowd was *enormous*, at least twice as large as the quarter-million that turned out for the first STS (Space Transportation System, i.e., shuttle) landing. They had to call out units of the California National Guard to help manage traffic.

I hope someone in Washington got the message. A half-million people went out to the Mojave Desert in July, to camp in a place that has absolutely no facilities: no water, no latrines, no shelter, nothing. They drove for at least four hours each way through the desert, many in the heat of the day. All this so they could watch the routine landing of the STS.

It was a well-behaved crowd, too. *Columbia* landed. The president spoke standing in front of *Enterprise*. At the end, *Challenger*, riding piggy-back on a 747, took off for the Cape, first circling overhead. By that time the crowd had been waiting in the hot sun for two hours—and in the Mojave, hot sun means *hot*. Yet everyone cheered.

If the low ratings on TV killed the Apollo program, then surely this fantastic support ought to help convince Washington that space is popular again?

Meanwhile, back in Phoenix, I was able to spend an evening with my colleague Harry Stine, his charming lady Barbara, and their three retrievers. His house is a veritable space museum: models, autographed books, gadgets, even a smidgen of moondust

Now, Harry's views on the financing of the space revolution *(The Third Industrial Revolution,* to use the title of his essential book on the subject) have often been stated (sometimes, I think, deliberately overstated) in this column, to wit, not only that government ought to get the heck out of the way and let a private space program develop, but that it's not going to be possible to get the government into the space business. That game is all played out.

But is it? Although he didn't announce anything spectacular, the president *did* go to the Mojave Desert in

July; and while the facilities for the president are better than those for random visitors, I can tell you from personal experience that the best Edwards Air Force Base has to offer is pretty crude. Moreover, Independence Day is our most important national holiday: presidents, particularly this president, think of it as an opportunity to draw attention to something important.

In fact, if you paid close attention to the president's speech, he sounded like a space enthusiast, as disappointed as any of us that he couldn't give us a big, expanded space program. I suspect that if the economy were humming, we'd have heard a different speech.

For heaven's sake, the president of the United States stood out in the hot sun to watch the fourth landing of a big airplane! Alex says he's seen more exciting 747 landings.

Which leaves it squarely up to us: convince the Congress. We've *got* the president.

Which brings us to an action item. You're reading this in December, when they're deciding exactly what to say in the State of the Union address. If you give a damn about the space program, write the president and say so—and ask that he make good on Kennedy's promise that the U.S. become a space-faring nation. Ask him to announce a permanent U.S. manned presence in space before the end of the decade.

Do that right now. It's President Ronald Reagan, The White House, Washington DC 20500, and if you haven't a typewriter don't worry about it, do it by hand. Just do it *now*. I'll wait.

Yeah. I know. It's not very exciting, writing letters to the president and Congress and trying to talk others into doing the same. Handing out leaflets. Getting people organized—the L-5 Society and its Southern California chapter OASIS were out in force at both the landing and Westercon. It isn't exciting, and there's no sudden and dramatic end to the labor. You no sooner finish one campaign than you start another.

But it *is* effective. We are, quite surely and not all that slowly, changing the attitudes in official Washington. By "we" I mean the whole space community, of course. AIAA, AAS, DPS, Planetary Society, Project High Frontier, NSI, to name a few besides L-5. In addition to the organizations, there's the science fiction community, which furnishes a large part of the labor. It's worth the effort, friends. We are finally getting the point across: we aren't going to go away.

Most members of Congress don't yet believe we can change the outcome of an election, although here and there some are beginning to wonder. That's our next task: to convince them they better pay attention to us, that we have teeth. We needn't show very big teeth, you understand. After all, compared to most single-issue groups, we don't want very much, and unlike a lot of supplicants for federal bucks, we can make a good case for showing they'd get it all back with interest. But we do have to show some teeth, because the goal is to make it as politically impossible to be against space as it would be to introduce a bill to level the Grand Canyon and build a golf course on the site.

And we—you and I, the science fiction community, the readers of this magazine—can, will, must do that.

Why us?

Because it's our job. Because, whether we like it or not, we are the long-range planning department for the human race.

We are. You, me, the readers of this magazine. Indeed, I would wager that *Analog* readers include 25% of all the people alive who have ever in their lives spent more than a few hours seriously thinking about the far future.

Certainly the government doesn't. It ought to; I'd have thought government the proper institution for looking after our grandchildren's welfare. Alas, government seldom worries about anything past the next election.

Families used to, but few families plan several generations ahead nowadays.

Businesses don't. They're not even supposed to.

So who does worry about the next hundred years? The next thousand?

Not many. A few remarkable individuals such as Barbara Marx Hubbard and Buckminster Fuller. The L-5 Society (1060 E. Elm St., Tucson AZ 85719. $25/year. $15 for students. Join *now*). And a lot of science fiction fans. Of course SF fans do other things. We're engineers and housekeepers and draftsmen and police officers and farmers and students and janitors and teachers and technicians. Mostly, though, we're people who think, at least sometimes, about where humanity is going; and since almost no one else is doing that, we have both a challenge and an opportunity.

Which brings us to part two: some specific technologies we need.

I've heard three news items today. First, Secretary of Defense Caspar Weinberger says he's in favor of a vigorous military space program, and that we can build ICBM defenses in space. Second, that the Soviets have announced their intention of building a *big* permanently manned space station (they already have a little one). Third, we saw a Jet Propulsion Laboratory promotion film demonstrating a rudimentary five-fingered mechanical hand.

Obviously I'm not dismayed by the first item; indeed, I've worked with General Graham and Project High Frontier to try to sell the idea of space defenses. I'm tired of building more and more offensive weapons. It's time we scrapped Mutual Assured Destruction and tried Assured Survival, which means defenses. I know of no Western tradition that justifies killing helpless civilians in order to gain military ends, yet without credible defenses we're stuck with deterrence through international terrorism.

I'm a bit frightened by item two. If the Soviets have a big presence in space, it will inevitably be used for any military advantages they can get from it. Since they keep building offensive weapons in excess of any sane deterrent requirement, and they keep saying they hate nuclear war but they expect to win if one starts, it isn't comforting to see them move into the high ground. I don't even like the "trigger effect": that is, I'd as soon the U.S. went to space for our own reasons, not as a reaction to a Soviet effort. I've nothing against a military space program—but I sure as hell want to keep a civil and scientific program going, and I want room for private industry in space. I don't want the military to be the whole show.

The third item, however, is exciting. Alas, it wasn't true. I was a bit dubious about it when I saw it: Marvin Minsky and I argued strongly for NASA support for a five-fingered general-purpose hand back two or three years ago. The debate took place as part of a study of automation and space; then-Administrator Robert Frosch was present. The opposition came from John R. Pierce, chief technologist for the Jet Propulsion Laboratory (and known to science fiction fans as J.J. Coupling). Dr. Pierce argued that he could build a special-purpose actuator that would do any job better than a hand.

Of course John was right: that is, if you can describe the job, then it's probable that a special-purpose gizmo will do it better. If you want your robot to drive screws, it's obviously more elegant to have a motorized screwdriver built into the robot's arm than to have the poor thing have to hold and turn an ordinary screwdriver.

This is great as long as you know in advance *all* the jobs you want done. The problem comes when you want to send the machine to a remote location. As soon as it gets there, sure as hell there'll be something you didn't think of that you wish it could do.

The most versatile tool-handling gadget we know is something that really *hand*les tools—i.e., a hand. A robot with a pair of hands and a box of tools is a versatile machine indeed. Note that we don't have to teach the robot how to do everything: not so long as we can control it and see its output. The process is called "telefactors" or "teleoperated systems." In the science fiction world we've known them for a long time: we call them waldos, after the story by L-5 board member Robert A. Heinlein.

Waldos would be useful in a lot of places. They'd help us get over the botch NASA has made of managing space suit procurement (the new shuttle Extra Vehicular Activity or EVA suits cost $30 million *each* and hold no more pressure than the Apollo moon suits did; lack of good EVA suits severely limits shuttle missions). Astronauts with a good waldo could control outside processes from within the comfort of the ship.

They'd be useful in deep sea work. I needn't belabor the point. Waldos can *amplify* human presence. Alas, though, no one ever builds them. Instead, the designers look at their task requirements and decide it would be cheaper and neater to design a special-purpose actuator. Since they're right, as long as they're considering *only* their particular job, the hands never get built.

Yet waldos—which means hands, for we have the rest—are badly needed, and for a fraction of what we've wasted up blind alleys in EVA design we could have five-fingered waldos. Unfortunately, no one seems willing to put up the $100 million or so that would be needed. Industry people see more bottom-line short-term profit in special-purpose devices.

We'll prevail one day, though. Meanwhile, that's our other job: to spot things that need doing, and call attention to them. But then that's what any long-range planning department does. ■

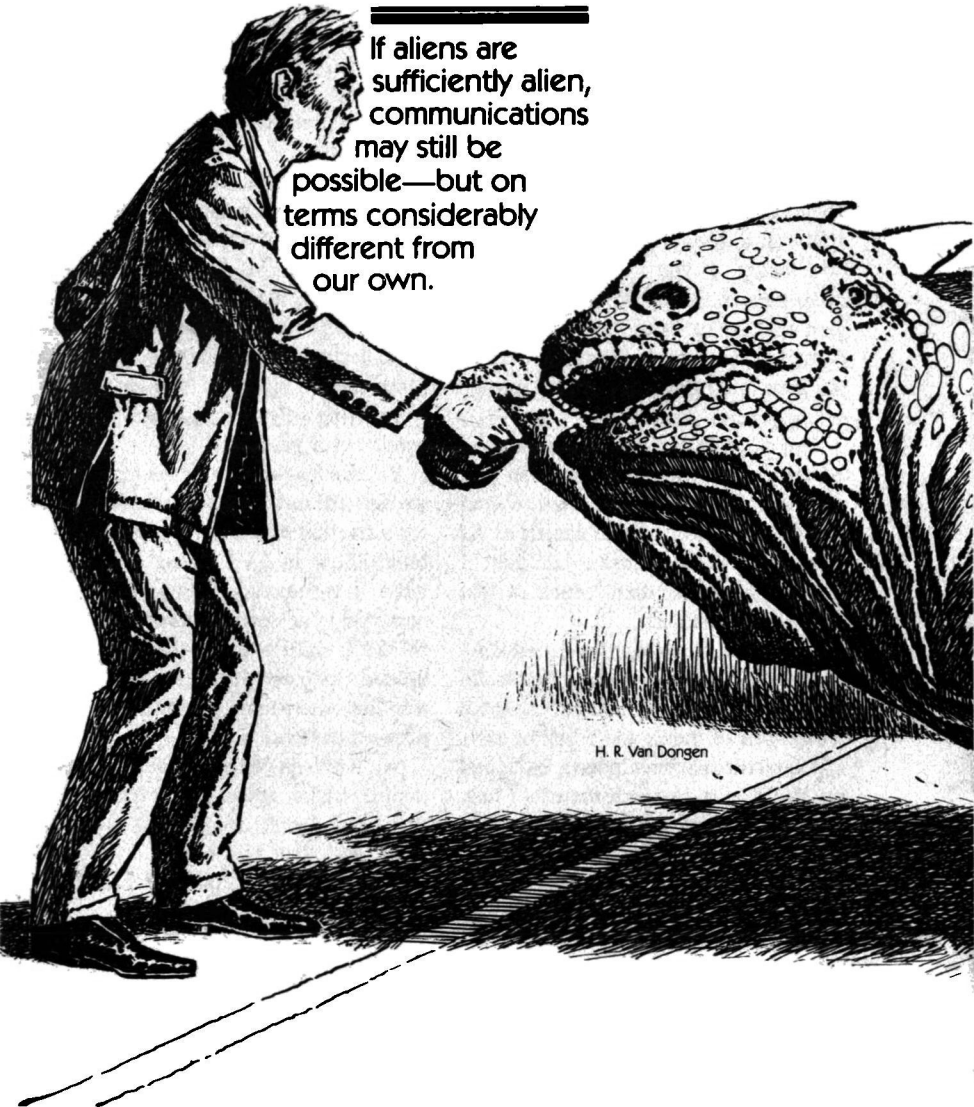
● Once you get to orbit, you're halfway to anywhere.

Robert A. Heinlein

Bill Hays

CULTURAL EXCHANGE

If aliens are sufficiently alien, communications may still be possible—but on terms considerably different from our own.



The first contact between the human race and an alien civilization occurred on January 20, 1987. We didn't find them. They came to us.

From the aliens' point of view, it was only a coincidence that the 1987 Super Bowl would have attracted the largest audience in history for a live television broadcast. They didn't know what television was, or understand its importance in our society. That was our mistake, too. Even our most brilliant minds tried to interpret their actions in human terms, and they weren't human. They were aliens—in every sense of the word.

Television coverage from the Houston Astrodome began an hour before the scheduled kick-off, while most of the fans were still fighting their way into the stadium. The Dallas Cowboys had one of the largest followings in professional sports, but they couldn't match the gloating arrogance of fifty thousand New Yorkers who had flown in to cheer their Buffalo Bills on to their first national championship in history. In the last game of the regular season, the Bills had beaten the Cowboys 24-21 with a forty-seven-yard field goal on the last play of the game, and the entire state of Texas wanted revenge. Tempers flared all over the stadium, and their chants of *"Kill, Bubba, Kill"* served as a psychic beacon for the aliens to lock onto and set their course by. If we had realized that, we might have treated them differently. The link that led them to us was not a radio signal, or a space probe, but revenge.

Robert Tobias Prescott noticed the hole while the Cowboys were being introduced on the field. As the youngest governor in Texas history, he had made a special request to be down on the field during the pregame activities. When the Dallas cheerleaders offered to present him with a bouquet of roses, he accepted graciously but made sure his wife was standing beside him for the television cameras. Susan Prescott hated football almost as much as she loathed the leggy Dallas cheerleaders in their short-shorts and their suggestive dance routines, and the last thing in the world that she wanted to do was smile prettily for the television audience while they gave her husband roses.

"I don't care what you want any more," said Susan, whispering through clenched teeth so the cameras wouldn't see her anger. "This is the last time. Absolutely the *last* time."

"Not now, Susan," said her husband firmly. "Not in public."

"I don't give a damn about the public. I don't give a damn about your image. I want a life of my Damn it, Toby, are you listening to me?"

Prescott wasn't listening to her. "Look up there," he pointed. "Above the fifty-yard line. What is that?"

"It's just a reflection from the stadium lights," said Susan. But it wasn't. It looked like a hole in the air, a black hole the size of a baseball, and it was growing larger.

A strange feeling came over Robert Prescott. He felt lost and confused, as if he was seeing the inside of the Astrodome for the first time. Even the people looked strange, and for a moment he couldn't understand why he had been so attracted to the scantily-clad women dancing in front of him. Why were animals wearing things like that, anyway? Then Prescott saw the same confusion

on Susan's face, and the world snapped back to normal. "Susan? Did you feel it?"

"Yes," said Susan. Her voice sounded a million miles away. "I feel so homesick. Let's get out of here, Toby. I want to make sure the kids are all right."

"They're fine," Prescott assured her. That had been his first reaction, too. "It's not that kind of message."

"How do you know?"

Prescott glanced up at the hole again and a cold shiver ran down his spine. Somebody, or something, was trying to communicate with them. Somebody who was a very long way from home.

"Come on," he said, grabbing Susan by the arm. He motioned for the stadium police to clear a path for them. "I've got to make a phone call."

"Don't pull me," snapped Susan, shaking off his hand.

"I want you with me," he insisted. "Come on."

Susan didn't have to ask who her husband was going to call. To anyone who knew anything about Robert Tobias Prescott, it was a silly question. "I hope he's watching this on TV, or he's going to think you're crazy."

Two minutes later, Prescott was describing the hole to the president from a private, glass-walled box overlooking the fifty-yard line.

"It's still growing. It's about the size of a car now, but I can't see anything inside it. It's black, like a hole."

"That's what they're saying on TV. They tried looking into it with a long-distance lens, but they couldn't get anything. I've got some people here, but I want your opinion. Do you think this is some kind of a Russian weapon?"

"No, sir." Prescott knew the Russians were far ahead of the United States in psychic research, but he couldn't believe they had anything like this. On the other hand, he didn't want to be labeled as the idiot politician who saw little green men at the Super Bowl. "I can only tell you what I felt. I was homesick, and I didn't recognize anything around me. Not even the people. I couldn't figure out why animals were wearing pieces of cloth around their bodies. I know what that sounds like, and maybe the Russians have a sense of humor we don't know about, but it's not their style."

"Then you think it's from outer space. They're trying to contact us."

"That would be my best guess, but I can't say for sure."

"Hold on." Prescott heard other voices talking to the president, but couldn't make out the words. He gave Susan a reassuring wink, and she squeezed his hand tightly. If there's a good side to this situation, thought Prescott, it's that Susan is frightened enough to come to me for help, instead of bitching about how damn independent she wants to be. Maybe I do smother her, but I don't do it on purpose.

"Hello, Toby," came the president's voice again. "My travel time to Houston would be three hours, but the Secret Service people are against it. I'm going to send the vice president down just in case, but I'll let him know that you're in charge. You've probably got some scientists from the Space Center in the stadium, and I'll get in touch with the

local FBI people if you want some back-up.''

''I'm already handling that from this end,'' Prescott didn't especially want the vice president in the stadium, for his own personal reasons. The networks would give a lion's share of their coverage to the ranking government official on the spot. Once the vice president arrived, the governor of Texas would be number two on the totem pole. If he was only going to have the spotlight for three hours, Prescott intended to spend as much of them on national telelvision as possible.

''Hold on,'' said the president. ''Something's happening.''

Prescott heard the entire stadium rise to its feet, and looked out the window at the hole. Only it wasn't there any more.

In its place was a floating sphere thirty feet in diameter, resembling a giant soap bubble more than anything else. Its surface appeared translucent, but not even the television cameras could make out any details of its interior. It descended slowly to the surface of the football field. When it touched the artificial turf, the bottom of the sphere began to flatten out, until it formed a dome on the fifty-yard line.

''Looks like your aliens have a flat,'' a voice laughed from the back of the room. Prescott smiled grimly, glad that somebody had broken the tension.

''I'm going down there,'' said Prescott, as much for the other people in the room as for the president. It was the kind of thing a decisive leader was supposed to say at moments like this. ''There's a phone down on the field. I'll get back to you as soon as I'm down there.''

''You be mighty careful down there, Toby,'' said the president. ''Always assume the worst and make your plans accordingly. No one's ever voted against a man for president because he overestimated an enemy.''

''I will, sir.'' He handed the phone to one of the guards with instructions to keep the line open, and turned to Susan. ''I'd like you to come with me.''

For a moment she hesitated. This was part of her husband's job, part of what he lived for; but she wasn't her husband. Susan Prescott was terrified of bubbles that appeared out of nowhere and creatures who thought of human beings as funny animals that wore strange pieces of cloth around their bodies. And yet she didn't want him to leave without her. ''All right,'' she smiled bravely. ''Let's meet them together. One small step for equality and all that.''

And maybe one small step for us, thought Prescott hopefully.

Down on the field, a depression appeared at one edge of the flattened bubble. Slowly it spread across the surface, until it formed a ramp that ran from the center of the dome to the ground at one edge. It was angled toward the nearest television camera crew, who kept their eyes pressed against their viewfinders and didn't say a thing.

At the top of the ramp, a bulge appeared. Something inside the bulge was trying to get out, but the skin of the bubble was holding it back. It took three tries before the skin finally ruptured and the alien appeared at the top of the ramp. Behind it, the skin of the bubble healed without a sign of the rupture.

"Oh, my God," said one of the sports announcers, putting the entire stadium's thoughts into words. "It's a giant lizard."

It did look like a lizard, twenty feet long from its snout to the tip of its stubby tail. It crawled down the ramp on all fours, leaving a trail of slime from its glistening green scales. It had no separate head, but the front part of its thick, segmented body moved from side to side, independently of the rest. There was no way to guessing what kind of intelligence lay behind its tiny red eyes, if indeed they were eyes.

The alien slithered to the bottom of the ramp and stopped, leaning back on its hind legs and tail. It seemed to be staring at the television cameras.

Waiting.

The cameras stared back, and through them, the entire world.

Robert and Susan Prescott saw the alien for the first time when they emerged from the tunnel under the bleachers. Susan dug her fingernails into her husband's arm and said, "I'm not going out there."

"Susan, please."

"Let someone else go. You don't have to."

He gently pried her fingers loose. "I won't go near it. I just want to get a little closer. Maybe I can talk to it."

"Is that what you want? Or do you want to grandstand for the cameras, so everyone can see you out there handling this crisis with your usual skill and finesse?"

"Darling, nothing's going to happen to us. These creatures are intelligent. They've crossed the stars to visit us. We can't just ignore them."

Susan stared fearfully at the giant lizard. She knew something horrible was going to happen, some terrible calamity over which she had no control. *Damn it*, she cursed to herself, *I have to run my own life. I can't let Toby decide everything for me.* With that sudden insight, she knew what she had to do next. "I'm not going out there with you. I'm going back to the box to watch you on TV."

"Susan, I want you with me out there. I need you."

"Not as much as I need myself. I'm sorry, Toby, but that's how I feel."

"I love you," he said gently. "I love you with all my heart, but I have to go out there. Do you understand? I have to go."

"Do you understand that I can't?"

Prescott nodded. He understood that she needed a life of her own, out from under the shadow of an ambitious politician. He also understood that it was the first time she had refused to go anywhere with him, and it marked a change in their relationship that could never be reversed. "I'll wave to you," he promised.

"You do that." She took his hand in both of hers and held it up to her cheek. "I still love you."

"I know."

Prescott kissed her gently on the cheek, and told one of the guards to escort his wife back upstairs. Then he slowly walked out of the tunnel and along the sidelines toward the alien ship.

"Governor Prescott?" A short, balding man offered his hand; the face was familiar, but Prescott couldn't come up

with a name. "I'm James Ridley from the Houston Space Lab. I understand the president's put you in charge here."

"Has she said anything yet?"

Ridley raised an amused eyebrow. "How do you know it's a she?"

Prescott shrugged. He didn't know, but the word had just popped into his mind. "*Can* she talk?"

"Not the way we understand it. One of the cameramen got a good shot down her throat; you can see practically all the way down to her stomach. I can't find anything resembling vocal cords. Nor teeth, for that matter. Looks like she's strictly a vegetarian."

"I wasn't worried about that," said Prescott. "Any intelligence that can poke a hole through space isn't going to mistake me for a cheeseburger."

"We're not sure she's intelligent yet," said Ridley. "The real brains could still be inside that bubble, or back home waiting to see if she comes back alive or not. She could be just a parakeet they pushed out to test the air."

"Or our reaction." The lizard acted totally unaware of their presence. "I think we should treat her like any other diplomatic visitor. Let's show her we're friendly and peaceful."

"I'd like to volunteer for that job," said Ridley.

"Sorry, it's already taken."

"This is no time for politics," argued Ridley. "Or politicians. It should be a scientist. I've devoted my entire life to space research. Let *me* take the risk. I think it would be a gesture *they* would appreciate."

"I'm sorry." Prescott touched his shoulder compassionately. He understood what Ridley was going through. Making the first contact with an alien civilization would be the crowning achievement of his life; for Prescott, it was just a stepping stone to a presidential election ten years away. "There's a pattern to communication. We establish contact, we find a common language, and then we exchange information. You'll be part of that exchange. I guarantee it. But this is my part. All I'm going to do is say hello and ask how she enjoyed her trip. We all have our parts to play. Don't begrudge me mine."

Ridley thought for a moment, then nodded once. "How soon are you going out?"

"Sooner the better." Prescott had waited in enough airports during his early campaigns to know how miserable it felt. "Let's make the little lady feel welcome."

Once the decision was made, it still took several minutes to set things up. A path was cleared into the locker room in case the alien decided to follow Prescott when he left. It would be easier to protect her there; Prescott winced at the thought of some drunken fan bouncing an empty beer can off her nose. The networks were notified of Prescott's plan, and he saw Susan's face on one of the monitors, being surrounded by reporters for an interview. He had never been prouder of her. She might be too scared to face an alien lizard, but she was tough enough to hide it from the rest of the world. A woman like that was worth all the trouble it took to keep her. Maybe there was still a chance to do exactly that.

There was a consensus among the scientists that he wouldn't need any special protection against alien germs or

microorganisms, first because the entire stadium had already been exposed and second because they doubted that extraterrestrial life forms would be compatible with human tissue. They seemed more worried about infecting her, and Prescott suspected they were glad to have him as their guinea pig. If either species was going to die from direct contact, they wanted to find out as soon as possible.

A technician pinned a tiny microphone to his shirt. "Can you hear me?" he asked, giving them a sound level. The engineer wearing headphones nodded, and Prescott took a deep breath. This one is for the history books, he told himself, closing his eyes for a moment to collect his thoughts. I hope you're watching this, America, because here comes your next president, courtesy of one giant lizard from outer space.

The television cameras were in position. Prescott smiled at the one with the glowing red light, and the entire stadium fell silent as he stepped out onto the playing field.

It's like being under a microscope, he thought as he glanced around the upper decks of the stadium. One hundred thousand people watching my every move, and they're only a drop in the bucket compared to the television audience. Nervous sweat trickled down his back, and he tried to keep his attention focused on the alien. If the lizard noticed him, she gave no indication of it.

Come on, Lizzie, he thought desperately. Just look at me once. Just so I'll know somebody's in there. You didn't come all this way just to ignore us.

Prescott stopped five paces from the foot of the ramp, his stomach rebelling at the creature's putrid smell. It reminded him of the last garbage strike in New York City, when he'd made the mistake of walking downwind from a seafood restaurant. It wasn't the odor so much as its intensity. It almost made him gag. Was that a clue about her home planet? Wouldn't odors be smothered by a denser atmosphere?

Lizzie still hadn't looked at him. What if she was some kind of test, to see if Earthlings could recognize intelligent life forms? No, that didn't make sense; anybody would assume that a creature who emerged from an interstellar vessel was intelligent. Prescott took a deep breath and bowed slightly in her direction.

"On behalf of the entire human race and the government of the United States of America, I welcome you to Earth." He wanted to wave a hand in front of her nose, just to see if she'd respond, but they'd misinterpret the gesture on television.

He moved one step closer to her. "My name is Robert Tobias Prescott. I hope you can understand my words." Damn it, what if she can't? I feel like an idiot out here. If you can understand me, Lizzie, give me some kind of sign.

As if she could read his thoughts, the alien shifted so that her eyes were on him. Prescott almost jumped out of his skin at the sudden movement, but he kept his voice under control. "I hope this moment represents the first step in a long and peaceful and mutually beneficial friendship between our two civilizations."

In front of seven hundred million television viewers, Prescott turned his

hands palms-up and raised them in front of him, in a gesture of welcome.

For a dozen heartbeats, nothing happened.

Then, as if finally making a decision, the alien lifted its left front leg and extended it toward Prescott, firmly pressing it against the governor's hand in an imitation of a handshake.

The contact only lasted a few seconds. Prescott felt a sudden chill as the slimy secretion from her scales oozed down his wrist. His instinctive reaction was to pull away, but he fought it. Instead, he closed his fingers around her claw-like foot and squeezed gently.

Somewhere in the back of his mind, he knew a hundred thousand football fans were on their feet, applauding and shouting to show their approval of his gesture of intergalactic good will, but it didn't seem very important. For some reason, Prescott felt very much alone, as if he had just lost everyone he had ever known or cared about.

Then the feeling disappeared, and he was back to normal.

Suddenly the alien yanked her claw away and spun around. Prescott had to leap backwards to keep from being flattened by her tail. He stared helplessly as she slithered up the ramp and ran head-on into the skin of her ship. This time the skin of the bubble parted at the first pressure, and automatically resealed behind her.

The bubble rose silently from the football field, returning to its original spherical form. Prescott held his breath along with everyone else in the stadium as it reached its original height.

Then the ship was gone. Vanished, as if it had never been there.

God damn it, cursed Prescott. What did I do wrong?

The first contact between two alien civilizations was over, and no one on Earth knew what it meant.

Robert Prescott spent the next three days in a decontamination room at the Houston Space Center, giving television interviews through a glass wall. His blood tests were consistently negative, but analysis of the slimy excretion on his wrist surprised even the scientists.

"The alien is incredibly similar to Earth life on a molecular level," one of the biologists told him. "We've found carbon chains that look almost like DNA, but there's a much higher percentage of potassium and very little calcium. I wish we knew what we're dealing with. It might be some kind of bodily waste, or part of the alien's reproductive process, or something else we haven't guessed yet."

"It makes sense," said Prescott. "We use the same atoms. They can only link up so many different ways."

"I wish we had a tissue sample. There's no telling what we could learn."

Through all the interviews, Prescott felt the unspoken implication that he had done something to frighten the alien away. No one had said that in so many words, but the thought kept him awake at nights.

"What if I didn't frighten her away?" he asked Susan, over the telephone beside his bed. "Maybe it took too much power to keep the ship here any longer than necessary."

"Then why did she just sit there and

wait for you to make the first contact? She didn't look like she was in any hurry to me."

Every time they showed the meeting on television, Prescott came up with the same answers. The alien had been totally unconcerned with her surroundings until he approached, and then she had reached out and *touched* him. Touching him was the key.

"Maybe she didn't want to leave us a clue. Maybe she read my mind. Maybe she just wanted information about us. Maybe we're looking for an answer that isn't there."

But he knew the answer *was* there, and they just hadn't found it yet.

Throughout his ordeal, Susan acted the perfect political wife, concerned and supportive in every conversation. Prescott suspected that the doctors had cautioned her against upsetting him, but he knew that wouldn't continue once they were alone. She was waiting for him on the other side of the glass wall when they finally released him with a clean bill of health, and they had a few moments together before they went out to face the reporters.

"I missed you, darling," he whispered, hugging her tightly against his body. "I missed you so very much."

"I was terrified that they'd find something some reason why you couldn't leave."

"It's over now. Everything's over."

Susan gave him a brave smile. "You haven't seen the cameras waiting outside yet."

"No, I mean it's really over." Prescott couldn't keep the bitter disappointment out of his voice. "They think I'm responsible. They think I frightened her away. I was *that* close, and I blew it."

"Nobody blames you," said Susan. "She touched your hand and she left. Who knows what it means? She might be back tomorrow speaking English just like you."

Robert Prescott had kept everything bottled up inside for three days. He needed to make Susan understand how he felt. "The whole world was watching me. I was the one. First contact with an alien civilization. My name in all the history books, and then suddenly she turns around and leaves. I look like a fool in front of the whole world and *I don't know why!* They're so polite about it, but inside, they're sure *I* did something wrong. My political career is over. Who would ever vote for me for president? Would you?"

"Darling," said Susan, smiling tenderly at him. "I've written in your name in every presidential election since I met you, and I'm not going to stop now. This could be the best thing that ever happened to us. No more black-tie dinners. No more grandstanding. You can stop running for the nomination twenty-four hours a day and start living again."

Robert Prescott couldn't hold his tears back any longer. There were so many things he wanted to tell her, things he had held back for too many years. "Only if you're going to be there with me. I don't think I'd want to start living again if you left now."

"I don't know yet." Susan knew she had to tell him the truth, no matter how much it hurt him. "I have to live my own life. I don't know if I can do that with you or not, but I'll try. So help me, I want to try."

"Let's go home," said Robert Prescott. There would never be a better time for starting over. "I think I'm ready to go home."

When he awoke in his own bed the next morning, Robert Prescott knew something was wrong. He didn't know what—until he noticed the fingernail on his right index finger.

It was green.

"Susan?" He woke her up gently, trying to keep his voice calm. "I think we'd better go back to the Space Center for some more tests. Both of us."

"I think you've already guessed what's happening." Dr. Albert Morrissey, Retired Admiral, U.S. Navy, and Chief of Pathology at Bethesda Naval Hospital, had flown into Houston to conduct Prescott's tests personally at the president's request. "Your cuticle tissue is mutating. From the color and the high potassium concentration, I'd say it's connected to your alien."

"You mean I'm turning into a lizard?"

"It's too early to tell. The process could stop at any time."

"But we both know it won't." Prescott shook his head helplessly. "What about Susan? Is she infected, too?"

"At this point, your guess is as good as mine. None of the laboratory animals exposed to the slime have been affected, but you had an incubation period of several days. We'll have to keep Mrs. Prescott here under observation and wait."

"I don't care what you have to do," said Prescott. "I want you to save her."

Dr. Morrissey sighed deeply. "Then you have a decision to make. Since the transformation started at the point of contact with the alien, we might be able to stop its spread by removing the finger. That would also limit the tests we could run, to find other ways to reverse the process."

"Start your tests," Prescott raised his hand. His finger was green down to the first knuckle, and the skin was thickening into green scales. "You've got a guinea pig, but I think you're running a little short on time."

"How do you feel?" asked Susan. They were back to talking over the telephone, only this time Susan was in an isolation ward of her own. "Does it hurt?"

"It itches. Not bad; it just itches." The green scales had spread across his palm and up his other fingers. The point of a tiny claw was growing where the first green fingernail had been.

"The doctors said they might be able to stop it if they amputate your hand."

"I've already made that decision," said Prescott quickly.

"I don't think it was your decision to make," said Susan angrily. "Not without asking me first."

Prescott was in no mood for an argument. "It's my hand, not yours."

"They're never going to find a way to reverse it. Not in time. Not if they had a thousand guinea pigs to experiment with. The quicker you let them operate, the better chance you have."

"I want them to finish the tests."

"Because I might be infected, too? None of the laboratory animals have shown any changes. It's not contagious, Toby. We'd know by now if it was."

"No, we wouldn't," he argued. "It

might take longer without direct contact."

"If there was a chance to reverse it, I'd tell you to wait, but there isn't. They don't have any idea how it works. Losing that hand won't make any difference to us, if that's what you're worried about. I don't want to lose you, darling. If I can only keep part of you, then give me that part right now."

Prescott knew she was probably right. None of the tests had found any trace of an alien substance in the rest of his body. Every second he waited, the chances of it spreading grew greater.

"All right," he said finally. "If that's what you want."

"It is," said Susan. "As soon as possible."

"Thank you," he said tenderly. "Susan, I know we've had our problems, and it sounds kind of trite to say this now, but you've always been there when I needed you. I still need you in my life, darling. And I always will."

When she started to cry, Prescott said gruffly, "Go blow your nose. I've got another call to make." Then he broke the connection and dialed Dr. Morrissey.

Forty minutes later, they started cutting. In another fifteen minutes they were done.

And it was over.

Robert Prescott didn't speak much in the next two days. He stared at the ceiling of the isolation chamber and thought about going through life with only one hand.

How long will it be before I can sign my name again? Or throw a baseball? I've never done anything left-handed. Will Susan still want to make love to me? How much will that stump where my hand used to be bother her? Will it ever be the same between us again? Damn it, why me? Why?

He remembered watching the movie *Peter Pan* as a child, and laughing when Captain Hook revealed that he lost his right hand to a crocodile.

Now I'm going to be Captain Hook, thought Prescott. *Only I didn't lose my hand to a crocodile. I lost it to a giant lizard from outer space. How would that look on a campaign poster?*

The second night, he stopped worrying about his campaign image when the stump below his right elbow began to itch.

"Don't give me your excuses!" Prescott held up his right arm and waved it in their faces. "How do I stop it?"

Dr. Morrissey had amputated eight inches of his forearm along with the hand, to be certain of removing the entire affected area. Now a tiny green arm was growing out of the stump, and its end resembled a claw more than a human hand.

"I don't know," said Dr. Morrissey. "I wish I could give you a better answer, but I can't."

A new voice entered the conversation. "Maybe I can."

It was the scientist, Ridley, from the Space Lab. Prescott made the introductions before he asked, "How?"

"You've been going on the theory that it's a chemical change," said Ridley. "Like the metamorphosis of a tadpole into a frog. But that change is programmed into the tadpole's DNA from the start. This is different. It's not

just altering the shape of his body; it's changing his basic cellular structure."

"And what's your theory?" asked Dr. Morrissey.

"We know the aliens are telepathic. Everyone in the Astrodome received the same message. Loneliness and homesickness. Emotions, not thoughts. Maybe we're too different to receive their thoughts. Maybe they had to make physical contact with one of us first." He looked at Prescott. "With you. To change you just enough that you can understand them. So you can receive their thoughts instead of just their emotions."

"You don't think it'll be a complete transformation?" asked Prescott hopefully. "Just enough so I can understand them?"

"Nothing else makes sense," said Ridley. "What good would it do to turn you into one of them? You still couldn't communicate with us. Changing your body doesn't accomplish anything; it's your mind that has to change."

"I have to disagree with you," broke in Dr. Morrissey. "So far all of the tissue samples demonstrate a complete metamorphosis. I've studied them in a chronological sequence from the day the governor entered this facility. The nuclear membranes appear perfectly normal in one slide. In the next one, they've dissolved, releasing the chromosome material into the cytoplasm. Later slides show new structures forming inside the cells. They probably carry out the same functions of reproduction and repair, but it's not a halfway measure. Every affected cell changes completely."

"Go back a minute," said Prescott. "Why can't it be a chemical change?"

"Size," said Ridley. "Human DNA stores five billion bits of information. The brain has a capacity that's ten thousand times greater, with about a hundred *trillion* neural connections. I can't believe any chemical structure could transmit that much information and not show up under the electron microscope."

"It could be a two-step process," suggested Dr. Morrissey. "A chemical substance to guide the cellular transformation and the memories fed in later telepathically."

"Why complicate things?" asked Ridley. "When that alien touched you, she established some kind of a telekinetic field that's controlling both parts. That's the simplest explanation. There's no reason to limit them to our scientific knowledge. We're wasting time examining tissues when we should be using our brains. And we know they're telepathic."

"I'm sorry," said Dr. Morrissey curtly, "but I wouldn't have any idea how to test for a telekinetic field. I'm a pathologist. If there's an alien substance causing this change, I'll find it." He hesitated and said in a calmer voice, "If you've got another theory, you're welcome to do any tests you want, but I'd be wasting my time trying to help you."

"I don't care what's causing it," snapped Prescott. "I just want it stopped."

"If it is a chemical change, we'll isolate it. I'm going back to the lab." Morrissey took off his glasses and wiped them on his lab coat. "I don't know if this will help any, Toby, but I'd change places with you if I could. I'm sixty-seven years old and I don't have too

many years left, but I'd gladly trade them for something as important to mankind as what you're doing."

"Me, too," said Ridley.

But I'm not sixty-seven years old, thought Prescott angrily. *I had other plans for the rest of my life. A lot of other plans.* "Don't look so disappointed, Doc. I've been doing some thinking about this, too. Either of you ever read Samuel Butler?"

Dr. Morrissey shook his head. "Anything in particular?"

"Butler once said that a hen is only an egg's way of making another egg." Prescott scratched at his right shoulder. *What happens when it reaches my brain? Do I stop being me? Will I still be human?* "You can't tell for sure whether this thing is contagious yet. If the transformation goes all the way and I can only communicate with other lizards, I might get lonely. I might decide to change a few of you for company. And a few more after that. I might not have any choice. Did you ever think about that? I might be the aliens' way of making a lot more aliens."

When the transformation reached his central nervous system, Robert Prescott lost consciousness and drifted into a half-world. His entire body itched furiously, but he couldn't move his hands to scratch anywhere. He vaguely remembered that he was strapped to a hospital bed, but he wasn't certain exactly what a hospital bed was.

In his dreams he saw a landscape with a dim red sun overhead, and others of his kind living in a murky swamp. They greeted him by projecting their emotions instead of speaking, and Prescott knew that he was tapping into the memories of the alien he had named Lizzie. He remembered the Astrodome as a flood of anger and hatred, as blinding and confusing as staring into a searchlight.

"You're torturing him," cried Susan Prescott. She watched him squirming against his restraints, seeking some relief from the constant itching. "Even if you're keeping him alive, he's still dying inside. Can't you see what he's going through?"

"The itching will go away in time," said Dr. Morrissey. "His right arm is beginning to secrete the same lubricating fluid that we analyzed at the start. He's uncomfortable, but I don't think he's in any real pain."

"How do you know?" Suddenly she couldn't hold it back any longer, and she broke into tears. "I want my husband back. I want Toby back or I'm going to go crazy."

Robert Prescott's features were vaguely recognizable beneath the green scales that covered his face, but his mouth and throat had changed too much for him to speak. His tail was two feet long, and growing in direct proportion to the amount of food he ate.

He was beginning to understand what his memories meant. The world with the red sun seemed more familiar with each passing second, and part of him longed to return to the cool mud.

The cool mud. That memory dominated his thoughts, accompanied by a curious sense of fulfillment and serenity. He tried to ask the small creatures who were feeding him about the mud, but they didn't seem to understand him. It didn't matter. He knew his own kind would be coming for him soon.

When the hole reappeared above the Houston Space Center, the entire human race watched it expand with morbid anticipation. They accepted Robert Prescott's sacrifice more easily than did his wife. If the aliens could create a bridge of communication between two entirely different life forms, who knew what other miracles they might have to offer?

Robert Prescott's transformation was complete. Two minds existed inside his brain, one human and one alien. Every thought traveled through two different consciousnesses, but instead of complementing each other, his two minds fought unrelentingly. When he tried to remember what his wife looked like, the alien part of him reacted with such repugnance that he tried to cry out in agony. And for the first time, Prescott understood why they had chosen this method to introduce themselves.

The lizards were only one part of a collective consciousness. They were symbiotic partners with the mud. When life began in the primordial ooze under the red sun, the rigid boundaries of cells and structure never occurred. The mud was a fluid organic mass, a single intelligent entity, and the lizards were only part of the world it controlled. In the struggle for dominance against the animals, the mud had all the advantages: continuity of existence, lower energy requirements, and telepathic powers. The mud had conquered its world, in a way humans had never dreamed.

"Prescott, can you understand me?" Three doctors in quarantine suits were wrapping him in plastic sheets for his trip outside. "They're coming back, Prescott. The aliens. They're coming back for you.

Prescott didn't need their explanations. He already knew they had arrived. That was the Directive. He was going back to explain that human beings didn't want to kill the mud. They only wanted to kill each other. The mud hadn't understood that human beings were individuals without a common mind to control them. In the mud's view of the universe, intelligence was immortal, and only animals died. No wonder it had been well, there wasn't any human word for it, but *confused* was close. Curious, maybe.

The truck carrying the twenty-foot-long body of the creature that had once been Robert Prescott backed as close to the alien ship as the driver dared. As soon as the restraining straps were removed, Prescott rose to his feet and raced toward the ship.

Susan Prescott stood next to Ridley and stared at the ship through puffy eyes.

"He didn't want to go with you," she whispered angrily. "You didn't give him any choice. He always wanted to come back to me."

Robert Prescott's tiny red eyes could not see in the brilliant light of Earth. The human part of his mind knew where he was, but his senses were alien, and they only recognized the ship that would take him home. A tiny part of him wanted to see Susan one last time before he left, but all he could do was sense her presence through her thoughts.

When he reached the ship, he recognized the creature he had once called Lizzie at the top of the ramp. It was like meeting an old friend. His human half wanted to smile, and his alien brain tried to project his feelings, but there was no communication possible between them now. It didn't matter. They both wanted exactly the same things.

Take care of Susan for me, he projected. *Love her as much as I did. She needs love and reassurance. She needs someone to be strong for her, and to be there when she needs help. Give her enough room to love her own life, and most of all, give her time. Eventually she'll realize that it's all for the best.*

As the two emissaries from different worlds passed each other on the ramp, the one in human form raised his hand in a sign of friendship. Robert Prescott gave no visible sign of recognition. His thought patterns were already crystallizing. By the time he reached the mud, he would be ready to merge.

"Susan?" The alien in the human body searched the faces in the crowd uncertainly. He felt so lonely. "Susan, where are you?"

When she heard her husband's voice, Susan Prescott began to scream. ■

● Life has a status in the physical universe. It is part of the order of nature. It has a high place in that order, since it probably represents the most complex state of organization that matter has achieved in our universe. We on this planet have an especially proud place as men, for in us as men matter has begun to contemplate itself.

George Wald

ON GAMING

Dana Lombardy

Editorial Note: *In the July 1971* Analog *John W. Campbell published an article about "Spacewar," the game developed at MIT in which players fought simulated space battles through a computer. "It's a great game," Campbell wrote in his blurb, "involving genuine skill in solving velocity and angular relation problems—but I'm afraid it will never be widely popular. The playing 'board' costs about a quarter of a megabuck!"*

John reckoned without the microchip and completely missed the explosion of video games, direct descendants of Spacewar, into homes and arcades in the ensuing ten years. The same period has also brought growing popularity to a variety of other types of games, some of which are becoming, in a sense, a new form of imaginative fiction.

The games column we're trying out here and in the next couple of issues is an experiment. As with any new thing we try, we invite your comments. If enough of you like something we try, we'll keep doing it; if enough of you don't, we'll stop. Ultimately, you—*not I or my boss—decide what will be in* Analog.

Serious readers of science fiction dislike being lumped, by the mass media or otherwise, with "sci-fi" types who wear Spock ears or read comic books.

Serious game players face a similar frustration. To the non-playing public, "game" denotes something trivial and juvenile. Saying that you enjoy the "classics"—chess, Go, backgammon—is OK, but saying that you're a game enthusiast gets raised eyebrows from most listeners.

Important changes in game designs have helped to change that image in recent years. New games directly related to science fiction and fantasy now fill the gap between the classics and the roll-dice-and-move, chase-or-capture parlor games.

Part of this is due to the electronics revolution which gave us the memory microchip. Part is due also to new designers who don't feel constrained by the tried-and-true methods of the past. Not surprisingly, many are SF readers who have turned their love of the genre into a business and livelihood. Rather than write a book or novelette to express their ideas, the authors of SF games create a game board or a rule book to tell a story.

But the greatest factor in the rise in playing is that the new games are *fun*.

At the 1982 World Science Fiction Convention in Chicago, Poul Anderson's "The Saturn Game" (*Analog*, February 1981) received the Hugo Award for best novella of the year. If you recall, the story involved a team of explorers who whiled away eight years' travel to Iapetus by acting out an elaborate fantasy which continued—with serious results—when they arrived.

The fictionalized explorers were caught up in their version of a role-playing game the newest and probably most distinctive of today's new-genre creations.

Role-playing games (rpg) generally call for two or more players plus a referee or judge. The referee doesn't actually play the game. Instead he explains the situation

and paints a verbal picture of the scenario as the game unfolds—performing a function similar to that of a movie director setting the stage for his actors scene by scene.

Before beginning the game, each player rolls twenty-sided percentile dice to determine the strengths and weaknesses of the character (role) he will maintain throughout the rpg. Characters use their dice-acquired "intelligence," "stamina," "dexterity," "strength," "charisma," etc. as demanded by each new game situation. Successful completion of a game earns a player "experience" points. This increases his character's abilities for use in future games.

This may sound simple, but the many options players must deal with make playing a complex process. A unique feature of rpg is that players often must cooperate with each other to overcome obstacles or achieve goals. Rather than competing, characters play as a group against the environment—the dilemmas—presented to them by the referee as they journey through an unexplored region, traverse a dungeon, or jump from one solar system to the next. If they don't, it's unlikely any character will survive to take part in future games.

Complaints that games serve only to teach competitiveness and a win-at-any-cost philosophy are negated by role-playing games. Effective employment of each player/character's skills, experience, and knowledge is the goal of the group leader—whether he's a wizard, a warrior, or a starship captain.

The rules to a typical rpg often run into hundreds of pages, including numerous charts on weapons, damage, types of aliens encountered, etc. Because role-playing games often are complex, it requires a high degree of intelligence and (usually) a high level of education to be an effective rpg referee. However, what makes these games compelling is that even a bright eight-year-old can play, since only the referee needs to know the nuances of the rules. The players must only respond verbally to the situations described to them by the referee. Knowing the rules helps, but it isn't vital to play. Common sense and imagination are more important.

Here is a brief guide to the more popular role-playing games:

Dungeons & Dragons® (TSR Hobbies, Inc., Box 756, Lake Geneva, WI 53147) is the best-known role-playing game. Introduced in 1975, it spawned the entire category, and is available in basic, expert, and advanced editions. It uses a fantasy ethos, including magic, and, as its name implies, most adventures take place underground against various monsters and traps.

In addition to at least a half a dozen other important fantasy-type rpg, there are also several historically based systems covering such subjects as the Roaring '20s gangsters, World War II, and feudal Japan. Those role-playing games which relate directly to science fiction include:

Aftermath (Fantasy Games Unlimited, Box 182, Roslyn, NY 11576) deals with the near future on a post-holocaust Earth. Before play begins, the players determine what sort of disaster struck the world.

Future World (Chaosium Inc., Box 6302, Albany, CA 94706) is part of a trilogy called *Worlds of Wonder*, dealing with magic, superheroes, and SF. Players

(Continued on page 177.)

Part Two of Three

ROCHEWORLD

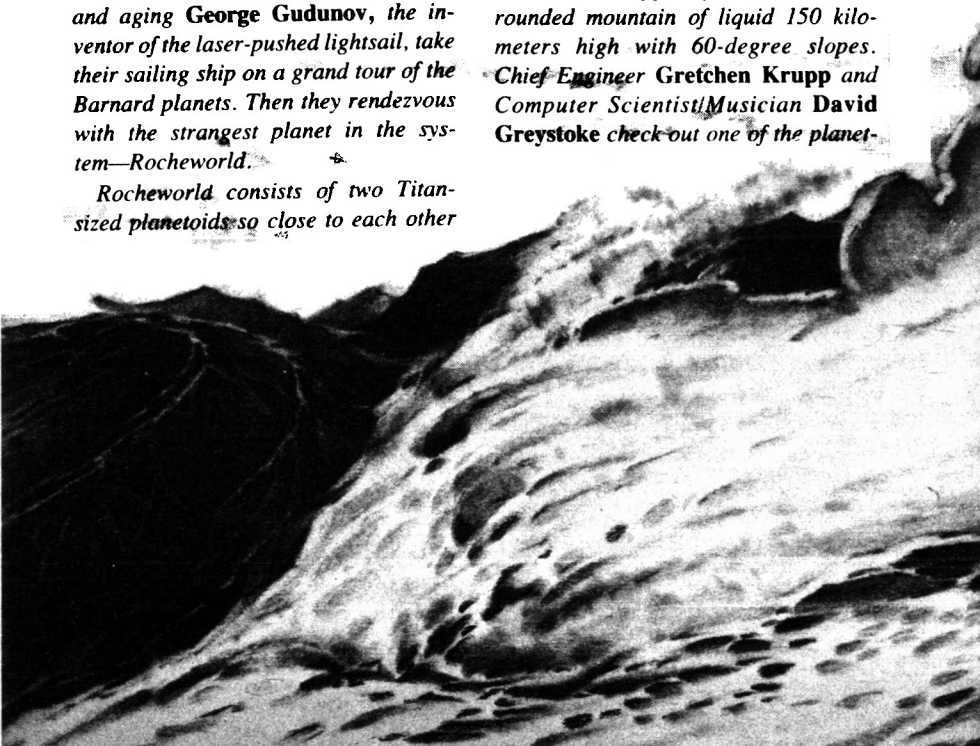
Dr. Robert L. Forward

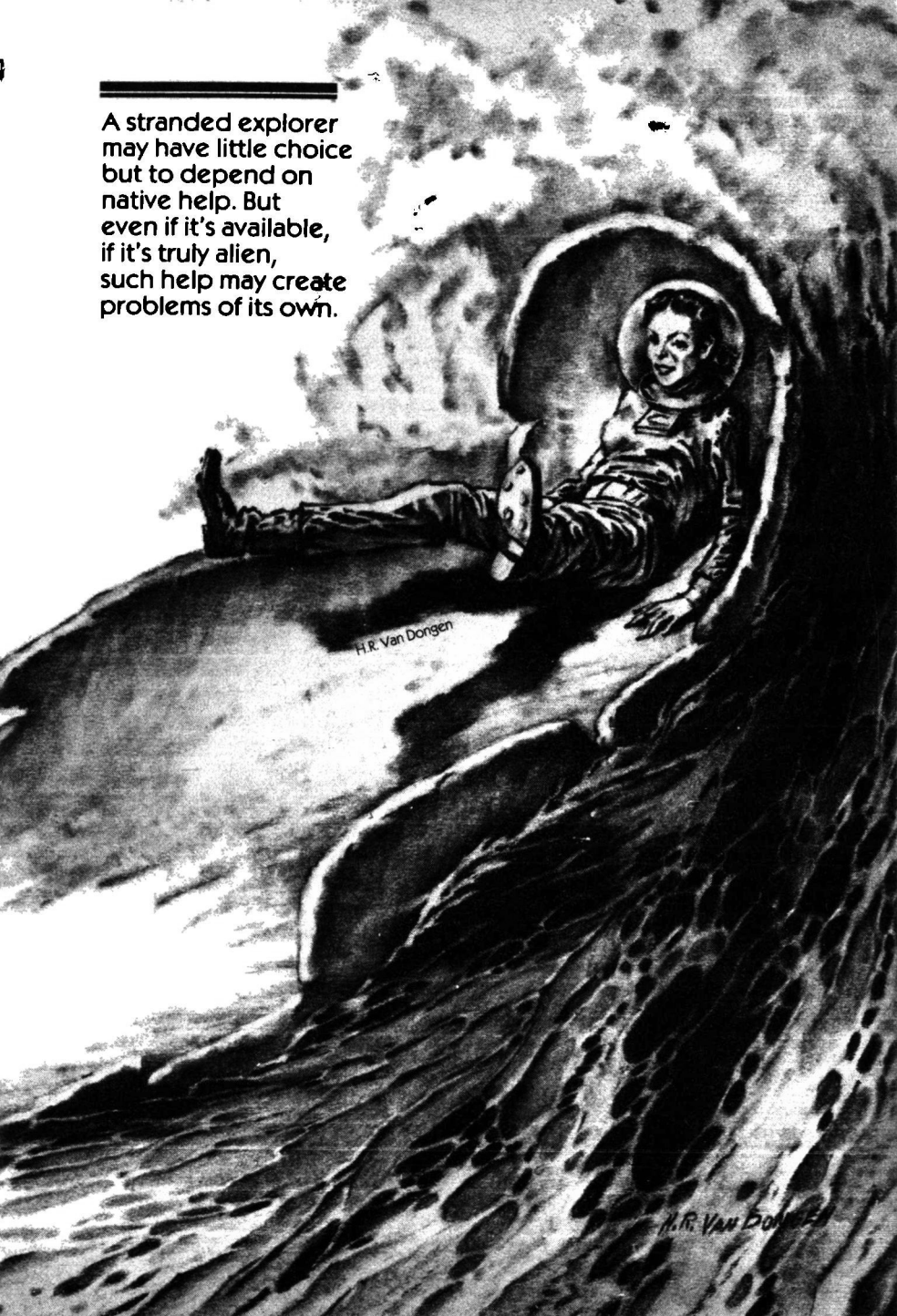
SYNOPSIS

A circular interstellar lightsail spacecraft enters the Barnard Star system at 0.2 c. It separates into two pieces. The small inner payload section falls behind and turns to face the larger ring-sail that is left. A two-light-year-long slug of laser light sent from the solar system reflects off the ring-sail mirror and bounces back the other way to decelerate the payload sail and bring its crew to a halt in the Barnard system. Using the weak photons from the red dwarf star, General **Virginia "Jinjur" Jones** *and aging* **George Gudunov,** *the inventor of the laser-pushed lightsail, take their sailing ship on a grand tour of the Barnard planets. Then they rendezvous with the strangest planet in the system—Rocheworld.*

Rocheworld consists of two Titan-sized planetoids so close to each other that they are tidally locked and constantly face one another. Each planetoid is drawn into an egg shape by the strong gravity of the other so that the two planets are only 80 kilometers apart at the peaks. Although their surfaces do not touch, the two planetoids share a common atmosphere of methane, ammonia, and water vapor.

The Roche (Rock) lobe is slightly larger and being the "highlands" is dry, while the smaller Eau (Water) lobe has captured all the water and is covered with an ammonia-water ocean that rises at the egg-shaped point into a rounded mountain of liquid 150 kilometers high with 60-degree slopes. Chief Engineer **Gretchen Krupp** *and Computer Scientist/Musician* **David Greystoke** *check out one of the planet-*




A stranded explorer may have little choice but to depend on native help. But even if it's available, if it's truly alien, such help may create problems of its own.
H.R. Van Dongen

ary landers carried by the lightsail, and heavy-lift pilots **Veronica "Red" Vengeance** *and Captain* **Thomas St. Thomas** *place the lander on the equator of the Roche lobe.*

Alien eyes float in the seas of Eau and watch the flare of light from the slowly falling rocket. A brain that is not a brain wonders at the phenomenon.

After George places the obligatory footprint on the dusty soil of Roche, geologists **Sam Houston** *and* **Richard Redwing** *explore the hills near by, but find nothing unusual except a strange crystalline silica-gel type of rock. There is no evidence of life. The landing crew assembles, and famed aerospace pilot* **Arielle Trudeau** *checks out the* Magic Dragonfly, *an all-purpose, nuclear-powered aerospace plane. It can hover on its electric lift-fans, fly through the air on its nuclear-heated jets, and take short hops through space using mono-propellant rockets.* Dragonfly *has a semi-intelligent computer named* **Jill,** *who manipulates its environment with the Christmas Branch, a bush-like motile whose every sub-division is a replica of itself down to the cilia at the tips, which move so fast they can make sound waves. Portions of the Christmas Branch can be detached and used for instrument repair and housekeeping. Each crew member has a tiny personal mini-branch—or imp— in his hair or on his shoulder for direct communication with Jill.*

Leaving Thomas, Red, and Sam at Rocheworld Base, Arielle lifts Dragonfly *on its fans and takes the rest of the crew off to survey the double-planet. Most of the Roche lobe is like Mars, with a cratered outer pole and ice caps at the north and south spin poles, while on the inner pole it is more like Io, with many volcanoes induced by the tidal stresses. Arielle flies* Dragonfly *up from Roche to the zero-gravity midpoint, then dives down to explore the oceans on the Eau lobe. There is still no trace of life, not even algae or bacteria in the water. Jill's scanner notices a strange amber blob on the ocean surface, but it disappears. The exploration crew visit the backside seas of Eau, then start their return before "summer" sets in. Rocheworld is in a highly elliptical orbit around Barnard. George wants* Dragonfly *tethered on the Roche lobe next to the lander during the high winds expected at the close passage to the star.*

On their way back they find a region near the equator on Eau where the ocean is shallow due to a field of underwater volcanic vents. They are taking water samples when a storm arises. The strong coriolis forces from the six-hour rotation period of Rocheworld cause the storm to turn into a swarm of tornadoes. Arielle tries to fly them out of danger, but a tiny twister lifts one of the long glider-like wings of Dragonfly *and the other wing digs into the top of a 100-meter-high storm wave. The* Magic Dragonfly *crashes heavily into the deep trough in back of the wave.*

CRASHING

Arielle lifted her face and hands from the top of the control stick. The back of her right hand was bloody and had two deep gashes in it. There was a small stone in her mouth. She spat it out. She watched the bloody hand move the stick

in slow motion as her left fluttered over the control board like a dying bird.

"Lift!" her mind commanded as she applied power to the VTOL fans. There was a low throb from the right wing.

Gretchen rose in her harness and clamped her throat shut. If the hull had been breached they were all dead. In near panic, she turned her personality off and went into emergency mode.

A woman ran down the sloping corridor right through the privacy curtain, leaving it in shambles. The woman yanked herself to a halt in front of the suit locker. There was a naked man slumped on the floor, his bath towel draped over his paunch. The woman ignored the man and pulled open the door to the suit locker. The woman donned a suit—for once without consulting a checklist. The helmet snapped into place.

The woman took a breath—and Gretchen looked around to see what she should do next.

"George!" Gretchen snatched a rescue ball from the top bin and zipped it open. Staggering a little on the tilting floor, she grabbed George by the arm as he started to slide. Lifting the 100-kilogram man easily, she stuffed him in the rescue ball head first. She reached down to the floor, picked up the bath towel, and stuffed it in after him. Another two seconds and George was zipped and pressurized. Gretchen hung him from a hook and started forward. She slipped on a twisted pile of twitching metal twigs.

"Jill?" she called.

"77A1FF—who?" came the reply.

Gretchen shook her head and a cluster of metal twigs fell from her hair down over her ear. Jill had crashed along with the airplane. Her left hand played over her chest control as she set up new communication links. Her right hand grabbed a wall bracket as throbbing engines twisted the airplane first one way, then the other. The floor tilted under her feet and her stomach sank. She had never liked boats.

Gretchen swallowed hard and forced her vision to level as she attempted to regain control of the computer. Codes long forgotten were dredged from her memory.

"SEM-1! GRETCHEN COMMANDING! PASSWORD NORDIC — PRIORITY FF! RESET TOP LEVEL!"

There was a second's pause. Her imp clambered back into her hair and the Christmas Branch raised itself from the floor, only to be knocked aside by Richard as the lurching of the aircraft sent him stumbling past into the end wall. Gretchen ignored him and pulled herself forward to pound on a Sound-Bar door, while holding it tightly shut with one strong hand.

"David! You okay?" she hollered through her revived suit-imp.

"Yes," came the muffled reply.

"We've crashed in the ocean. Don't open your bunk door until I check for air leaks!" She glanced up at Richard. He slowly and cautiously took a deep breath of air and held it. She took his suit out of the locker and helped him with the hard part, then made her way forward on the steeply sloping deck to the front.

Arielle was gunning the controls in time with the lurches of the waves and

firing the attitude jets in an attempt to lift the *Magic Dragonfly* into the air. She looked around as Gretchen approached in her suit. Gretchen was horrified at the sight of the beauty's face. Arielle's upper lip was a torn bloody strip hanging down over a gap in her teeth.

"We'f crathed," she said, a plaintive voice. "And there'th thomfing wrong with Jill."

"I'm okay now," came Jill's voice, calm and steadying. "I just can't see anything on my radar. It's the water covering the radome, of course. You might as well stop trying the fans and rockets, Arielle. The left fan is broken. Even if we could lift out of the water, we couldn't build up enough speed to clear the jets."

"How's the hull, Jill?" said Gretchen, relieved at having the semi-intelligent computer in control again.

"There's a minor leak in the left wing fuel tank, but I have a mini-branch making sure it gets sealed. No evidence that the life-support hull has been breached."

Richard came forward in his suit. When he saw Arielle he blanched and went back for the first-aid kit. The Christmas Branch took it away from him and led Arielle back to the shower to wash her off and repair her torn lip with a Neuskin patch. An imp came scampering out from under the pilot seat carrying a large white tooth with a bloody root.

Gretchen opened her helmet and sniffed the air. It smelled odd, with an acrid smell of fear. The odor died as the air-conditioning fans continued their work of keeping the electronics cool. She and Richard headed for the back, shedding their suits as they went. Gretchen heard a few mewling sounds from the shower and reached down to pick up the soggy, red-stained jumpsuit from the floor outside. On her way back to the work-wall she knocked on the Sound-Bar door and told David that it was safe to come out.

She stuffed the jumpsuit into the sonic cleaner and took off her helmet, giving it a careful check as she did so, since she had neglected to when she put it on. It wasn't until she and Richard opened the helmet locker that she remembered George. He was still in the rescue ball, hanging from a hook. She handed her suit to Richard and zipped open the bag.

There was a rustle as the imp inside adjusted the towel and spoke. "He'll have a nasty headache when he regains consciousness, but there's nothing broken. Could you give me a hand in getting him to his bunk?"

"I've got him," said Richard, giving her back her helmet and reaching past her to take the rescue bag off the hook. "You and Jill have to figure a way to get us out of here."

"Are you sure the left fan is out?" asked Gretchen.

"Both fans were in the maximum forward position to maintain speed when the left wing struck the top of a wave. Immediately thereafter there was an overload in the acoustic sensor on the fan drive shaft followed by a rapid increase in back-reaction from the electric motor, raising the drive current to dangerous levels. I shut the motor down. Subsequent override commands by the pilot produced heat surges in the windings of the fan motor, but no rotation as measured by the tachometer."

"Which you checked out with its self-test circuits."

"Which I checked out," said Jill.

"It's bent and jammed then. I'd better go out and take a look at it."

"Although we are afloat, with the cockpit windows out of the water, the tail of the ship is submerged," said Jill. "The airlock exit is underwater. I do not advise exiting."

That stopped Gretchen for a moment. "Richard showed our suits can handle water," she said.

"My airlock is not designed for liquids," said Jill, using its severe tone.

Gretchen knew her computer.

"If I can't get out the airlock," she said. "Then I can't fix the fan. The crew will have to stay inside until the life-support systems fail and then they will all die."

There was a pause. Not a full second, but a noticeable fraction of one.

"The purging systems of the airlock can be reconfigured to accommodate liquids," said Jill. "Cycle time will double since I will have to purge twice. Once with super-heated air to evaporate any residual drops and liquid films, and once again to ensure purity before breaching the inner lock. You must have your suit cooling on full power during the hot-air phase."

"Fine," said Gretchen, putting her helmet back on. "Cycle me through."

She experienced a moment of panic as a gush of water splashed down from two vents in the ceiling of the airlock. Gretchen ducked under the thundering jets and peered through a rivuleted visor at the foaming swirl on the floor. Her feet were cold and she felt the warmth of the boot heaters as her suit tried to compensate for the loss of heat. In a minute the sub-zero ocean water of Eau was up to her waist. The buoyancy of her suit in the water began to lift her feet from the floor. She grabbed onto wall rungs to keep from being swept under the crashing foam.

"Let some air out of my suit," she hollered. "I'm floating." She heard a hiss from her backpack and the water pressed hard on the wrinkled glassy-foil covering of her suit. As impermeable as metal, the glassy-foil was as flexible as plastic because of its non-crystalline structure. Nearly a millimeter thick, it could shrug off anything except the point of a knife blade. It did wrinkle under pressure, however, and the cold water pressed through the thermal layer of the suit and chilled her skin. The water burbled in and the air vented out until the door could be opened, letting a giant oscillating ball of air loose to make its way to the surface. Gretchen followed it out.

"Leave the lock open and the lights on," said Gretchen. She swam out into the broadening column of light, then reached for the permalight on her belt. The spearing ray of light swung up to illuminate the fan well. There was a black gap where one of the blades was missing. Near by she found the twisted metal blade. It was impaled on a support strut.

Gretchen looked at the nightmare of twisted high-strength steel. It reminded her of Arielle's mouth and was just as devastating to the inherent beauty of the *Magic Dragonfly*. She kicked downward and tilted herself back until her chest camera was pointing at the scene,

while pulling down her holovisor to monitor the picture as seen through the viewfinder of the electro-camera. It was blurred. The camera lens had been designed to interface between space and air, not water and air.

"Can you compensate?" she asked Jill.

Instantly the blurred image snapped into sharp focus as Jill adjusted bits to compensate for the index of refraction of the water as well as the slowly varying distance to the image.

"Got it," said Jill.

"Now to get a top view," said Gretchen, kicking up to the surface and grabbing the trailing edge of the wing. She raised her helmet above the water and, just before it was engulfed in a breaking wave, saw the dawn rising over Roche. Silhouetted in the pink light was the Christmas Branch, carrying an electro-cam and making its way carefully back over the water-washed wing.

"I have that side," said Jill.

Gretchen clenched her chattering teeth and let herself drop beneath the waves. A few strokes and she was back in the lock. A water-lock this time, as powerful exhaust pumps sucked the water from beneath her boots.

"We'll have to ballast the boots and the back-packs so the suit can stay inflated, to prevent contact with the legs and arms," she said.

"Good idea," said Jill. "Now turn around and let me dry off your back."

As Gretchen turned and rotated her body under the blasts of hot air, she could see steam rising from the shiny metal film of her suit. The suit cooling cut in and she was just beginning to complain that it was getting too hot when the cycle shifted. A few minutes later she was inside the plane. George was standing there with a worried expression, holding the back of his head.

Gretchen took off her helmet and reported.

"It doesn't look good. The fan is busted. One blade twisted beyond repair and another one missing."-

"Can you clear the twisted one and get the rest rotating?"

"Maybe," said Gretchen. "But that will leave it unbalanced. I could remove another and turn it from a six-blade to a three-blade propeller, but I don't think that will lift. Perhaps we could jury-rig another blade or two, or perhaps arrange a counterbalance."

"You work on it," said George, as Richard helped her out of her suit. Richard's arm brushed hers and he felt the clammy cold.

"You're frozen!" Richard said with concern.

"Not much worse than a deep dive in the Pacific Northwest," said Gretchen. Still, she didn't complain as he moved around behind her and gave her a long hug, his strong arms giving the firm muscular ones beneath them a warm embrace.

"How's Arielle?" she asked, basking in his warmth.

"George and the Christmas Branch reinserted the tooth, and she now has an imp-brace in her mouth holding it in place. The Neuskin patch should heal the tear with at worst a hairline scar, but she's going to have a fat lip for awhile." Richard, his own arms too cold to be of much good anymore, let her go.

"I think I'll go forward and check out

the instruments," he said. "You and Jill had better concentrate on fixing that fan."

He headed up the rocking corridor while Gretchen returned to the task of hanging up her suit.

`Come see what I found!`

What!?!

`A big animal as hard as a rock, but it floats!`

Wow! Where?

`This way.` The milky white cloud streamed off through the ocean, followed close behind by the red one. They approached the floundering winged metallic whale with caution.

You're right! said the red one, sending pulse after pulse of sonar signals at the distant object. The pulses varied in pitch and complexity as the powerful voice of Roaring*Hot*Vermillion attempted to peer into the inner portions of *Dragonfly*.

All I can see is the outside! It's too hard!

`There are some portions that are not as hard. Come closer.`

The two moved closer to the drifting aircraft. They were curious but cautious, since the huge plane was as big as they were. As they moved, their sonar pulses continued to scan its length.

`There are places near one end where you can almost see through. Those are also places where you can "look." The beast seems to have small hot suns inside it, and they shine out through those places.`

LOOK?!? SUNS!?! The red alien was bewildered. Its body was sensitive to light; when it was spread over the upper surface of the ocean basking in the warmth, it could tell roughly where the sun was in the sky, and whether a cloud had passed in front of it, but it had no eyes, so it didn't know what the heavens looked like. Its visual world was one of sound. Its sound pulses allowed it to see everything in its underwater kingdom, including the insides of its comrades. This was the first time it had met a beast that wasn't completely transparent to its piercing stare. As it approached the hard-shelled creature, the various portions of the red body could feel the diffuse beams of light coming from spots near one end of the long central body. As Roaring* Hot*Vermillion got closer, its body could "look" better, since some portions were close to the light sources.

`Get real close. Then you can not only see a little better, you can look better, too.`

The red cloud pressed itself onto the hard glass of the cockpit window and tried to see in through the murky glass. Its burst of sonar energy penetrated the glass quite easily, but on the other side was nothing but air, so most of the sonar signal reflected back and only a small portion entered the cockpit to illuminate the objects there. The acoustic return also suffered the same loss as it moved from the low-density air back into the high-density glass. There was not much left of the sonar signal by the time it flowed back through Roaring* Hot*Vermillion.

Can see some hard things inside, but there is a nothing in the way and it makes it hard to see.

`Are you looking too?`

*Yes. Many little suns. Too far away

to look at well. They are all blurred together.*

Arielle looked out at the reddish-colored haze obscuring her right side window. Must be another one of those strange, colored blobs. Suddenly her head hurt. She stood up and moved around, trying to shake the feeling.

Something is moving inside! A blast of high-energy sonar sang through the glass and burst into the low-density air beyond. Arielle winced again, although she didn't know why.

It is a long thing with a sphere on one end and straight portions coming out of the sides and bottoms! It's too much work to see. I give up. Let's go surfing?

`Maybe I can see.` The white cloud slithered over the red one and flowed onto the next panel of glass in the cockpit window.

Arielle noticed that while the right side window of her cockpit still bore the reddish tinge, the front window on the right now had a milky white appearance. There didn't seem to be any blending of one into the other. She frowned. She didn't like it. Her eyes shifted to pay attention to the perfect break between the two colors at the cockpit window frame.

Clear`White`Whistle tried again. She sent burst after burst of sonar into the strange hard beast, but saw nothing new.

`You're right. There's a nothing in the way. It's like trying to see above the top of the ocean.`

Let's go surfing! I can feel a big one building up!

`Let me try looking.`

I already tried! Too blurry!

Clear`White`Whistle didn't answer, but formed a portion of her body into a disk shape. The disk grew thicker in the middle, and the milky white color of the flesh faded away into clarity as the milky macromolecules containing the genetic essence and nerve tissue flowed out of the disk region, leaving only the clear basic structural substance of the alien body.

A portion of the red cloud darted about the construct, noting its shape and looking at its clear color.

Strange! What is it made of?

`It is me. Or part of me.`

Why does the disk bulge in the middle?

`So I can "look" at things from a distance.`

Can't! You can only look at things when they are right next to you!

`With this fat disk I can.`

Really!?! Let me look!

`Hold still!` the white one commanded, and holding the disk between the skin of the red one and the cockpit window, it used the crude lens of jelly to focus an image of the interior of the cockpit on the skin of Roaring*Hot* Vermillion.

It looks tiny!!! came a roar. *What is it?*

Clear`White`Whistle took the lens and put it in front of its own body.

`There are lots of little suns. Some square. And there is that moving thing you saw. Looks funny. The sphere has ugly fuzz on it, and a slit that keeps opening and closing.`

I can feel that big wave getting closer and closer!

`You're right. I can feel it, too.`

The lens was dissolved. The two huge blobs slithered to the top of the wing and launched themselves onto a large curling wave that washed over the drifting *Dragonfly*. The two aliens surfed expertly along on the wave, their recent discovery ignored in the excitement of the ride.

Arielle's headache lifted, and as it did she noticed out of the corner of her eye the lifting of the milky and red haze from the windows of the cockpit. She moved forward and, kneeling on the co-pilot's seat, tried to peer out into the murky water.

There was nothing.

Arielle was tempted to ask Jill if the computer had seen anything, but realized that Jill's electronic video sensors were just as limited as her electro-chemical video sensors in this frigid ocean. She swung around into the seat and ordered a position update from the console. There was an almost imperceptible delay in the response. Arielle's test-pilot-trained brain noted the anomaly.

The barrage of sonar sounds had taken Jill unaware. It had heard some strange pings and chirps from a distance a few hours ago, but after they had disappeared it had relegated the noises into its permanent memory under "Geology, volcanic, vents, noises from." The noises reappeared, however, and at close range—so close that they were obviously not volcanic in origin.

The science scan video cameras and the other sensors built into *Dragonfly*'s body helped put together the picture. There were a red blob and a milky blob of water that moved slowly—like unformed clots of seaweed, seemingly floating with the tide. The blobs were completely amorphous, with no structure seen in either the video or infrared sensor. The inside video camera had confirmed the colors when the two blobs washed against the cockpit windows. The shape information went to a portion of Jill that had been programmed to be on the alert for signs of alien life forms. There was no match to the program, for it had been trained to recognize symmetry and non-randomness as an indicator of life. The information was bounced back into memory and the alien-finding portion of the program was turned off.

The sonar input, after processing in both frequency space and time space, was also sent to the test-for-alien-life program. Soon urgent messages were running through the master-bus, calling back the stored shape information and activating a search through every sensor that had collected the least bit of information at that critical time period.

There was a moment's pause as Jill responded to the bothersome query from the human Arielle concerning a position update. That done, full computer brainpower was applied. Strange scents were extracted from the noisy data in the chemical sensors that monitored the outside conditions. Unfortunately, there was no new sensor data coming in, so the analysis had to make do with the sensor records. But the records were not good enough. Jill was almost sure that it had seen evidence of life—an intelligent life form. But what it had seen was not what the humans had expected, so the evidence was not conclusive. Jill would not bother the humans until it had done more calculations.

Jill thought.

"I need better sensor data," said Jill finally.

"What's the matter?" asked Gretchen.

"I'm blind," said Jill. "I have lots of information from the infrared and video cameras on the two scanners in the 'eye' domes, but they are half-awash in the ocean. Besides, as an airplane, I'm used to having the long-distance vision of radar. How can I protect you if I can't see things coming from a distance?"

"There's not much I can do," said Gretchen. "Your radar dome is under the ocean, and the water won't pass the microwaves. If you're going to insist on being a boat, you'll have to find some way to have me change your radar into a sonar."

There was a pause. "Okay," said Jill. "Change my radar into a sonar."

"Can't be done," said Gretchen, slightly perplexed.

"You said that all I had to do was find some way to change my radar into a sonar," said Jill. "So I did."

"You did!"

"We have spare parts for the under-ocean scanner. In fact, we have a complete spare set plus duplicates of all parts except the frame," said Jill. "The sonar array of the ocean scanner has almost the same design features as the microwave scanner in my radome."

"That would make sense," said Gretchen. "They both have the same wavelength, even though one uses radio waves, while the other uses acoustic waves."

"The piezoelectric sonar array uses higher voltages and lower currents than my semiconductor-diode radar array," said Jill. "But I have reconfigured the electronic driver to handle that. All I need is someone to replace the microwave diode array with the piezoelectric sonar array."

"Can't the branch do that?" complained Gretchen. She could still feel the bone-cold waters pressing on her flesh.

"Not by itself," said Jill. "It is out there now, rewiring the connector ."

"All right! All right! I'll do it."

Gretchen donned her suit and slowly cycled through the outside lock. It was still dark, so she took her time as she swam under the wing and along the left side of the *Magic Dragonfly*. She splashed upward far enough to peek through the cockpit windows at Arielle, then sank beneath the waves. She got out her trusty Swiss Army Mech-All and, rotating it until she came to the correct slide switch, instantly formed a strange screwdriver from one of the many triggerable memory structures in the complex metal-alloy head. The blade was shaped like the curved surface of a penny. Gretchen jammed the blade into one of the curved slots on the radome and twisted. A flat metal screw head popped out. Gretchen sank a little and attacked another slotted inset screw head.

"Here," said Jill, its Christmas Branch handing her a thick circular plate of metal with crossed slots in it. Gretchen took the microwave transmitting array and handed the branch a heavier cluster of square ceramic tiles.

The branch took the cable dangling from the back of the sonar array and connected the cable to a jet-black box.

The arms of the branch jammed the black box onto the electrical connector that penetrated the radome from the sealed interior. The box stuck. There was a pause and Gretchen hollered.

"OUCH!" said Gretchen. "It makes my teeth ache."

"Good," said Jill. "That's the tooth-sensitizing frequency. How about this?"

"I feel sick," replied Gretchen.

"The infrasonic portion is working," said Jill. "Now the ultra-high band. Do you hear or feel anything?"

"Bow-wow," said Gretchen, her ear tips trying to curl up. She closed the radome, being careful not to leave any trapped air that would impede the sonar signals.

"I can see!" said Jill through her imp. "I have to wait a number of seconds before the distant parts of the image come in, but I can see again!"

"What can you see?" asked Gretchen.

"We're on the side of a gradual slope that extends for kilometers," said Jill. "The slope reaches a plateau some 10 meters under the surface of the ocean. There are some volcanic vents there."

"Richard was right," said Gretchen. She began to feel the cold. "I think I'll go inside and tell him."

"I have already informed Richard of our find through his imp," said Jill.

"I think I'll go inside and tell him anyway," said Gretchen.

George was sitting at the science console monitoring the flow of data from the imager memory banks through the satellite data link to Prometheus. Even though they might not be able to get off this world, their data would.

There was a buzz from one of the flight consoles. A blinking light on one of his side panels indicated that a communication link from Roche Base had been opened. He switched the communication console controls to his science console and answered.

Red's face appeared on the screen. Her hair was tousled and she looked like she had missed a night's sleep. There was also a suspicious redness around her eyes.

"I may have a solution to your problems, *Dragonfly*," she said. "I don't know whether it will work or not "

A deep voice broke in from the other side and Thomas's face peeked into the pickup.

"Sure it'll work," said Thomas. "I'd've never thought of it, since all I've ever done is haul cargo from heavy-gravity planets. It took a rock-hound like Red to think of this one. I have Jack figuring out the optimum trajectory and the fuel margins we will need for various hovering times, but it should work fine."

"Great!" said George. "But what is it?"

"As you know," said Red, "the ascent module from the *Eagle* doesn't have enough fuel to take off from Roche, land on Eau, and take off again, even if we lighten it by throwing off everything movable. It does have enough fuel, however, to take off from Roche and travel over to the zero-gravity region between the planets, hover for a minute or so over the water mountain, pick you up, and still escape out to the L-5 point. *Prometheus* can then sail in and pick us up from there."

Greatly relieved, George lit up as he listened to Red. Gretchen had privately

told him that a repair of the VTOL fan was impossible, but had taken out a work crew to attempt a fix anyway. She just might be wrong, although the chances were slim, but it kept the crew busy doing something about their near-hopeless predicament.

"That sounds terrific!" he said to the hopeful faces on the screen. "I hope Jack doesn't find anything wrong with it. We're a long way from the water mountain, but we'll get there if we have to swim!"

"Fortunately, we have lots of time," said Thomas. "How're your supplies holding out?"

"No problem there," said George. "The good food is going fast, but it will last us for a few more weeks. Then we have the emergency rations, and if worse comes to worse, Jill can make us sugar syrup out of the soup we're sitting in. We're probably good until one of the recycling units develops a failure that Gretchen and Jill can't fix. With that kind of time, we could even paddle the plane the thousand kilometers up the mountain."

Jill's voice broke in, "The distance from our present position to the top of the water mountain is one thousand two hundred and forty-three kilometers."

"Thanks," said George sarcastically, thinking of the sweat each one of those kilometers represented.

Another computer voice interrupted. It was Jack this time. "The proposed mission plan is feasible. Hovering time near the peak of the water mountain varies from 20 minutes to 30 seconds at low tide. I have left a reserve of fuel for final rendezvous maneuvers with *Prometheus* at the L-5 point. The reserve can be used if it is necessary to extend the hovering time."

"Good!" said Thomas, turning and leaving the screen. "Show me the trajectory on the command console."

"Are you sure you can get there?" asked Red.

"Don't worry, Red," George said. "I was only kidding about swimming or paddling this flying submarine. I'm sure Gretchen will figure out some way of getting some propulsion for *Dragonfly*. We have plenty of power; it's just that we're used to flying through air, not water. I'm going to tell the crew the good news that we have at least one way off this smelly egg." He turned off the communications console connection and talked to his imp.

"How does it look to you, Jill?" he asked.

"I have all the mission data from Jack through the data link," it said. "The only problem that was not mentioned is that we have to work out some way to protect you from the ascent module jet exhaust. Jack was planning to turn off the jets and free-fall slowly down while the crew is pulled up with a winch."

"That sounds a little tricky," said George. "I'm sure we can arrange some sort of blast canopy made up out of some of your wing panels with a pickup ring on top."

"I hadn't thought of that," said Jill. After a second's pause it said, "That will work, too; the metal is light, but it will not be in the jet long."

"Good," said George. "Are there any other potential problems?"

"How are you going to travel those

one thousand two hundred and forty-two kilometers?"

"I thought you said one thousand two hundred and forty-three," said George.

"I did," said Jill. "But we are coming to another high tide and the currents in these regions are 20 kilometers an hour. We have moved closer to the peak."

"Well, that's a start. Too bad we can't anchor somewhere while the tide is going the other way."

"You can," said Jill in its detached voice. "The water is only a few tens of meters deep in this region."

George gave a long laugh, his emotional relief at finding a means to rescue his command finally breaking through to the surface. He pounded a key on his console to link the audio pickup to all imps and suit-imps on the ship.

"Avast there, ye sky-lubbers!" he boomed into the mike. "Hit the deck and come a'running! This is Captain George, and I want every Man Jack and Jill to assemble amidships. I have good news, me hearties; we're setting sail for home."

As he said those words, George had another thought. He whispered to his imp, "How much cloth do we have on board?" The reply was lost in the confused clamor of voices coming over the audio link on the console. There was one voice that he took particular care to answer.

"Yes, Gretchen," he said. "I want you and your crew too. We'll probably never be able to get *Dragonfly* in the air again, but Red has come up with a plan where we don't have to. Instead of making *Dragonfly* into an airplane again, we're going to make her into a boat, and we'll need you in on the planning session since you're the only one other than Jill who knows *Dragonfly* inside and out. Unfortunately, Jill doesn't have any imagination, and that's what we're going to need a lot of if we are going to get off this world while we're still on decent rations."

Within a minute George heard the first of the airlock cycles as the outside crew boarded and came forward wearing their suit briefs. Arielle, who had finished her shift, had been sensibly asleep, her calm test-pilot nerves allowing her to keep up her necessary rest schedule. She had tried to find a decent place to get dressed, but finally gave up and came out in her sleepwear—a pair of warm pajamas with elastic cuffs and booties. Her spare frame had always suffered under the temperatures that the endomorphs around her found comfortable. In her furry pink suit, surrounded by a smelly crew dressed in sweaty suit-tights, she looked like a small child captured by a pack of space-pirates.

David swiveled in the computer console chair, practically his private preserve. His thin face seemed even leaner with its hint of orange-red stubble. He blinked his eyes tiredly a few times and shook his head to keep awake in the unaccustomed warmth of the body-heated room after his hours in the cold seas of Eau.

"Don't keep us in suspense, George," he said, pushing his glasses up on his nose. "How're we going to get home? Are they going to send another SLAM down to pick us up off some mud-flat?"

"I'm sure Jinjur would do that if it were necessary," George said. "But Red has come up with another idea so

that we don't have to waste two landers on the same planet. If we can get to the low-gee region on the top of the water mountain, she can pick us up there with the ascent module." Gretchen listened to George's speech, whispered for a while to her imp, then finally broke into the conversation.

"We could use the tidal currents to get there, dropping an anchor when they're in the wrong direction, but that wouldn't work when we start up the water mountain. The ocean becomes tens of kilometers deep. We could think about a sail, but neither Jill nor I has been able to come up with enough mast and sail to make a significant difference. There is another alternative, and that is to use *Dragonfly*'s VTOL fans in a slow-rpm mode as a water propeller instead of an air propeller. Not very efficient, but it would give us a number of knots. The problem is that only one of the VTOL props is working. If we ran just that one, we would go in circles." Gretchen stopped and her eyes widened for a second. The rest of the crew could almost see the light-bulb above her head. She whispered something to her imp. There was a moment's pause. Then the crew felt a slow throb coming through the hull from the undamaged right engine. George walked upward to look out the cockpit windows.

"We're moving," he said.

Gretchen jumped down off the galley counter and strode forward. She sat in the co-pilot seat and tilted her head to one side to line up the center of the window brace with one side of the rocky globe hanging in the sky ahead of them.

"Have you got the rudder hard over?" she asked Jill.

"Yes," said her imp.

Gretchen watched, then shook her head slowly as the nose of the craft drifted off to the right. As they started to turn back the way they had come, Gretchen called a halt.

"The fan can move us at a significant speed," she said. "But even with the tail rudder and ailerons doing their best we still travel in a circle, going essentially nowhere."

"How about a sea-anchor on the port side, way out on the tip," suggested David, trying to dredge up what little he could remember of his distant sailing lessons on Earth.

Gretchen didn't answer. She leaned back in the co-pilot seat, her mind flipping through page after page of the engineering manual for the *Dragonfly*. Jill was not idle, and Gretchen would occasionally nod as something was whispered into her ear by her imp. Suddenly she rose from the chair, strode down the length of *Dragonfly*, and entered the narrow corridor at the rear that led to the air conditioning and renewal banks.

Although Jill had a brain that ran on as little electrical power as possible, that brain still used a significant number of picowatts per thought. The air conditioning on *Dragonfly* was not meant for the comfort of the crew, but to keep Jill's brain cool enough to eliminate "soft" errors due to thermal excitation. Gretchen opened a louvered door and peered up. She stopped, went back to the suit locker, obtained a permalight, and returned. She flashed the brilliant white beam up past the cracks between the flutes on the cooling fins of the air

conditioning system, to the air fans overhead. Then she punched a seldom-used code into the permalight's microcomputer. Her thumb on a two-way variable switch, she sent the beam upward again. A few practiced flicks and she could see in the strobing flashes of light the air fans seemingly slow and come to a stop as the blinks of light from the illuminator in her hand matched the turns of the blades.

"How about those?" she asked her imp. "They're small, but one or two of those run at the proper speed could push as much water as the VTOL fan."

"Those are part of the air supply," Jill remonstrated in her severe tone. "Regulations do not permit any diversion of primary life support systems to other purposes."

Gretchen replied in a firm voice, "The purpose for which the fans would be used is essential to the welfare of the crew. Please record my recommendations in your priority memory banks and verify with the commanders of *Dragonfly* and *Prometheus*."

There was a short pause. Gretchen heard a gruff "She's right," from the front of the aerospace plane. Then she heard Jill speak again through her imp.

"The substitution you suggest will work with proper control of the relative rotation rates of the two fans. There will be a 20% degradation of the air flow throughout the *Dragonfly*. That will leave us at only 90% of nominal. My motile branch is not capable of removing the fan. The weights and gravity are too much at this location."

"That's all right," said Gretchen, greatly relieved that the computer had given in so gracefully. That probably meant that the substitution was a piece of cake.

It wasn't.

Jill's branch did all it could by unscrewing bolts that human fingers could never have reached, but the bulky fan looked for a while to be in its bay to stay. There were access plates that allowed the whole air recycling unit to drop out of the bottom of *Dragonfly* for installation and maintenance, but they could not be used when they were deep under the smelly ocean of Eau. Gretchen was dripping sweat before she finally had twisted the recycling units aside enough to get the fan through the door. At that, she had had to trim some of the support structure with a laser cutter. The sharp edges of the fan, a meter in diameter, and its support seemed to reach out to nick her flesh as she struggled into her suit-all, then into the spacesuit that proved to be as good in water as it was in space.

Despite her weariness, she carefully went through her checklist with Richard, then checked him out. She sent him through the lock first, then inserted the fan, allowing it the privilege of having the lock all to its razor-tempered self. After Richard had removed the deadly square with its slowly rotating fan from the lock, she cycled through, then followed him as he floated off under the left wing. Gretchen reached to her toolbelt for a large omni-wrench and took care of the obvious bolts on the outside, while a large segment of Jill's inside branch snaked its way into the wing and took care of the inside connectors. Gretchen motioned Richard back while the last of the connections were loos-

ened. The heavy fan with its missing teeth dropped from the wing and settled slowly in the low gravity. It was approaching another night cycle, so they could follow it down only a few meters.

Gretchen said, "Mark that position!" just as Jill reported, "Position marked." That was not the only time they had both been thinking the same thoughts on this long mission.

The next chore was to install the small air-conditioning fan in place of the much larger propeller. Richard had no problem positioning the fan in place with most of the blades under water, but the amount of space left required some sort of bracing. Gretchen looked over the situation in the dimming light, making length measurements as well as illuminating the scene with her versatile permalight. Dusk settled in on Eau and the two called it a day. They hung the fan in the gaping hole on *Dragonfly*'s wing, swam to the hull, and cycled through.

George and Arielle were relaxing for the first time in many days. They were watching one of David's computer compositions in the large-screen color display above the computer console. Each wore an extra section of the Christmas Branch as stereo headphones. David was improvising some additional audio and visual effects to add to his previously recorded compositions that would thrill billions of others six light-years away on Earth, when they heard it a half-dozen years hence.

Listening to the music and watching the video, George thought that David was at his peak, tired as he was—or maybe it was because he was so tired. Looking at the console, George saw with relief that someone, probably Jill, had turned on the high fidelity sono-video recorder. This exultant evening of genius would not be lost.

There were noises from the rear of the aerospace plane. They really didn't interfere with the concert, but George's command responsibility made him pay attention. He finally identified the sound as that of two large people trying to take a shower in the same small booth. He made a motion with his hand near one ear as if turning a knob, and the volume on his earphones increased, drowning out the noise from the rear. He relaxed and returned to the beautiful video.

Twenty minutes later Gretchen came through the privacy curtains. She picked her way through the relaxed humanity clustered around the computer console and went to one of the cockpit consoles. George noticed her passage and got up to follow her.

"Where's Richard?" he asked.

Gretchen smiled a knowing grin. "He's snoring away in a bunk. Had a lot of exercise today," she explained.

"So have you," said George. "Don't you think you ought to get some sleep before daylight in three hours?"

"Before we can go out again we'll need a fairly complicated bracing structure made. I thought before I dropped off to sleep Jill and I could design it. The branch can be building it while I get a good nine hours' sleep. I've been on the go for thirty hours." She patted her tummy. "Hmmm. My stomach thinks my mouth's on strike." She interrupted Jill's computations to order up a double-dinner of chili, then flipping her braid over her shoulder, turned to grin at George.

"It's going to work, George," she said. "It's going to work."

The music through the imps grew stronger. George felt an increased weight as the branch added some mass to the stereo pair of imps that surrounded his ears like a perfect headphone. David was now improvising, and the effect was like a fairy nimbly scampering up the stairways of the gods. George's eyes had automatically closed as he heard the charismatic sounds, but then he forced them open as he realized that he was in the chamber of a lyrical genius, one who wrote emotions with the colors and tones of light and music rather than the scratches and snarls of words.

No longer was this place a dingy, crowded corridor filled with aching, sweating bodies, but the vast empty corridors between the starlanes of the galaxy. His eyes, his ears, his soul drank in the new freedom from the fleshly bondage that had been the inheritance of the human race for the long-fettered grey mass of the human brain now saw greater things.

The greater things drifted in from the ghost-like shrouds of haziness. Then —with the music adding substance— they grew to take over the vision, still avoiding the direct glance, the firming up, the human desire to make desire a reality.

David, inspired by his own feedback, took off on another improvisation. The scenes repeated, yet were different in a subtly significant way. The music counterpointed from one disparate theme to another, while the images mixed and blended. There were new, more complex interrelationships. The scene and sound came to a dramatic climax. As it did, George knew only that he didn't have enough experience to appreciate it. If he had heard and seen that display on the screen without preparation, he would have hollered for a repair technician. Yet he knew that the sono-vision was just as the artist had wanted it.

The remains of the music and scenes echoed through the hallways and chambers of his mind. There was a long pause, in which the only sound was that of David taking a few deep breaths, Gretchen pecking at keys up front, and a long sonorous rumble from a bunk in the crew quarters.

"Oooohhhh!" said Arielle, her breath finally released. "Ooohh! Nife!" she said again, her gaze passing through the blank screen on the bulkhead to the stars beyond. She finally noticed where she was. Blushing slightly, she pulled her long pink bunny legs up to her chin and grew silent. A shy grin flickered on her lips above her clasped hands.

George, still out of his element, tried to express the gratitude that he felt for witnessing what was obviously a rare moment in artistic creation. He knew only that his faulty sense of appreciation had captured but a small portion of the fountain of genius that had flowed over him.

"That was really, really good, David," he said. "I mean I really, really liked that one. It really made a really great impression "

He had the sense to stop.

MEETING

For the next two day-night periods,

there was no recurrence of the strange blobs and their noises. Jill's program had still not decided what the phenomena were. They were obviously not intelligent life forms, since an intelligent being would certainly want to explore such a strange artifact as Jill imagined itself to be. They might be alive, since they certainly were complex, at least in their chemical composition and acoustic signature, yet their complete lack of shape seemed to indicate the two forms were just drifting blobs of jetsam, probably formed from the interaction of the complex water composition with some nearby volcanic vent. The acoustic noises could come from the thermal and chemical interaction of the blob with the surrounding water. There was certainly no reason to bother the humans with its speculations.

Then Jill's sonar, peering ahead through the endless ocean, heard a response to its searching pings. They had the same pitch and structure as the noises that it had heard nearly twelve hours earlier: strong, loud, and almost raucous.

HI!!! HI!!! HI!!! said Roaring*Hot*Vermillion.

`Who're you talking to?` said Clear` White`Whistle.

It's the big floating rock! It can talk now! I think it wants to play!

The red cloud changed its body ripples from a slow, wave-leaning gait, and slithered off toward the distant pinging ahead.

Jill's sonar system saw the distant blobs separate. One came directly at it at high speed. Jill increased her interrogation rate and switched to a modified chirp in an attempt to pick up shape information. The blob was about three meters wide, ten meters long and one meter thick, but it had almost the same density as the ocean and had no discernible internal structure.

`Careful! came the call from the distant white cloud. It could be a new type of Gray:Boom! It might explode and catch you.`

The thought slowed the advance of Roaring*Hot*Vermillion, but didn't decrease the volume of its voice, which it raised to a shout.

HI!!!!! WANT TO SURF?!?!?!

Jill took in the sound, then echoed it back, more softly since it was limited to 100 watts of power by its jury-rigged sonar system.

"HI! Want to surf?!" Jill said, then waited.

Roaring*Hot*Vermillion paused a second, nonplussed at hearing its own voice, weak though the echo was.

HI!!

"Hi!"

HI! HI! HI!

"Hi! Hi! Hi!"

HI! HO! HI!

"Hi! Ho! Hi!"

Roaring*Hot*Vermillion caught on quickly. This thing, which didn't seem to be able to move much, obviously didn't know how to communicate, so it was limited to repeating what it heard. The red cloud had come across others of its kind that had spoken such strange dialects that it took almost a light-cycle to get accustomed to each other's slang so they could talk together.

This strange thing didn't seem to know anything about talking, but it still was smarter than the hunters and flitters,

who had their own sound and could not imitate the spoken voice. This thing could even imitate Roaring*Hot* Vermillion's own overtone patterns. The obvious thing to do was take it through some simple mathematical logic. First the numbers, then simple combinatorial mathematics, then formal logic, then on to a few physical referents such as you, me, water, dirt, sky, and some diagrams on the bottom, and they should be conversing in a light-period.

One! Two! Three! Four! Five! Six! Seven!

There was a pause as the numbers trilled through the water. Each spoken number was by its multiple tonal and pulse-code pattern a living example of the concept of the number it represented. The word "Three" was a melodic triplet of sounds with each note given its own triple-tongue beat. Each number also had its own set of overtones that were distinctive as bell, violin, and brass. The number seven was a manifold wonder that Jill stored in memory in its pristine acoustic beauty to present to David when he was in the mood to compose.

*One plus one equals two.

One plus two equals three.

"One plus three equals four," interjected Jill.

The red cloud turned itself inside out.

HEY!!! VERY GOOD! Won't take long for you to learn! There was an outpouring of sound beamed off into the distance.

Come here, Clear`White`Whistle! This strange hard floater is as smart as a new-formed one!

*One plus One plus One equals said the red cloud, waiting for the answer.

". . three," dutifully responded Jill.

Three TIMES One equals Three! said Roaring*Hot*Vermillion, jumping from addition to multiplication. Jill caught on instantly.

"Two TIMES Three equals Six!" said Jill, almost triumphantly.

zzzzzzzzzt!!! came an explosive sound. *SsSsSsIiIiIiXxXxXx!* said the red cloud, enunciating each trill and overtone with exaggerated care.

"SSSsssIIIiiiXXXxxx," said Jill, its electronics still stumbling over the acoustic nuances of the word.

zzzzzzzzzt!! exploded the red cloud, so Jill tried again.

"SsSsSsIiIiIiXxXxXx," said Jill's sonar finally.

I do believe it's GOT it!!! The red blob turned itself inside out again, and dashed off to meet the still approaching white form.

It's SMART!!! I think I'll keep it!!! I'll name it Floating:Rock!

`It may not want to be kept. Besides, Floating:Rock doesn't seem to swim too well. It won't be able to follow you around.`

Oh!!! Right! Well, you can have it! I'm going surfing! The red cloud swam off into the distance.

Jill took advantage of the interlude to inform the crew of its find. They came crowding to the cockpit windows to see the giant alien creatures. There was a large red alien swimming away, while a slightly smaller white cloud hovered in the water at a distance.

"They are definitely intelligent, despite their amorphous shape," reported Jill.

"Do they have names?" asked Arielle.

"I haven't progressed that far yet," said Jill. "Even when I have learned their names I doubt you would be able to pronounce them. The red one is quite raucous, so I'll call it Loud Red. The other uses a higher-pitched clear tone, so I'll call it White Whistler."

"How can such large aliens exist in these barren seas?" asked Gretchen. "We've been over all of Roche and most of Eau and taken lots of samples. I'm sure you and I would never have missed seeing a life-form, even a single-celled one."

"I suspect that the only life to be found is right around the active volcano vents," said Jill. "Life here never developed photosynthesis, so all you have are animals. Even a one-celled animal cannot survive except right around the vent fields where the energy source is."

"It's like the little colonies of strange sea creatures that cluster around the sea bottom vents back on Earth," said George. "They live off the hydrogen sulfide escaping from the vents. There is even a large worm-like creature with no mouth. It gets its food from hydrogen sulfide-eating bacteria living in its skin."

"Well, these creatures are even weirder than those we have on Earth," said Richard.

"Look," said Arielle. "White Whiftler if coming clofer."

Clear`White`Whistle approached the strange metallic-tasting beast. There should be many things it could learn from this strange thing that was hard like a rock but floated. For instance, there were those strange things moving around inside Floating:Rock that had stiff sections connected by joints.

Since Floating:Rock had eaten the Stiff:Movers, perhaps they would be tasty, but Clear`White`Whistle had never seen anything like them in this region of the ocean. If Floating:Rock could be taught to talk, it would tell them where to find the strange Stiff:Movers. Clear`White`Whistle continued the lesson.

`Three times Two equals Six.`

"Two times Three equals Six. One times Six equals Six. Two plus Four equals Six. Three plus Three equals Six. One plus Five equals Six," said Jill, trying to make it clear that she had figured out the addition and multiplication tables. So far, there were no numbers greater than Seven. They must use an octal numbering system. There was one way to find out.

"Four plus Four equals said Jill and paused, waiting for the answer.

`One-OOOhhh,` came the answer from White Whistler. Jill had been prepared for the One, but this was the first time she had heard the haunting emptiness of the zero. It sounded like the unheard echo of an invisible ghost.

Jill decided to speed things up. The next step was the subtraction tables. "One *BEEP* One equals OOOhhh. BEEP equals?"

Clear`White`Whistle was impressed. Floating:Rock was now asking questions.

`BEEP equals minus. One minus One equals OOOhhh.`

Jill jumped from mathematics to logic. "One equals One."

`Yes.`

"That must be either 'yes' or 'cor-

rect,' " said Jill to itself. "Now to find the negative "

"One equals Two," Jill's sonar beeped.

`No.

and more and more words were added to Jill's all-retentive memory as the red sun started to set once again behind the mountain in the sky.

Gretchen had been following Jill's conversation with extreme interest, but she was more interested in the aliens' bodies than their minds.

"Do you think we could get a sample of one of them?" she asked Jill. "I'd really like to find out what they're made of. I'll get into my suit and slip out the lock while you keep them talking."

"I would advise against that," said Jill. "These beasts weigh at least ten tons and are intelligent. Even if you could snatch a sample, I'm not sure you would survive to bring it back."

"Then ask them for a sample," said Gretchen, sure that her request would be granted. "Tell them it is of vital importance for my research."

Jill started to protest, but Gretchen had made her way back to the suit-locker while she was talking and was putting on her suit. Her imp was kept busy scrambling to keep out of the way.

It took a few minutes for Jill to get the concept across to White Whistler, but as Gretchen had expected, the alien readily acquiesced. Gretchen cycled through the lock with a specimen container, a pair of scissors, and a syringe. As she approached the alien, bobbing in the icy liquid, she began to realize just how big these creatures were. The fact that there were no eyes to focus her attention on was one of the more bothersome aspects of meeting the jellyfish-like creature, yet she could feel and hear the multitude of pings and whistles passing through her body as long thick appendages grew from White Whistler and nearly surrounded her on all sides, each emitting sounds as she was thoroughly scanned. One of the thick appendages turned into an inquisitive flexible finger that wandered over the specimen bottles and her tools, while another one felt her over thoroughly. Jill kept up a constant conversation with the alien as each item was examined and many words were added to their joint vocabulary. Satisfied with its inspection, the alien withdrew slightly, and a strange voice came from the imp on Gretchen's shoulder as Jill translated.

`What do 'scissors' and 'syringe' do?`

"The scissors cut . ." she held up the scissors and snipped them rapidly, then carefully cut a tiny portion from the frayed end of her safety rope. Jill translated, and an action word was added to their joint vocabulary. The alien extended a milky-white tendril and pulled the cut piece of rope inside its body, tasted it for a second, and spat it out.

"The syringe sucks . ." Gretchen worked the plunger and brought it near the surface of a nearby appendage so it could feel the stream of sea-water shooting from the end of the large needle. Before she could move to avoid it, the appendage impaled itself on the needle and the syringe was half-full of milky white liquid before she could stop.

"OH! I'm sorry! I didn't mean to do that until you were ready! Are you hurt?" said Gretchen.

`Syringe sucks,` said a quiet voice through the imp. Gretchen felt an appendage surround her hand, then firm up. Gently, but with great power, her fingers were removed from the syringe. A portion of the appendage formed into a crude hand which took hold of the operating end of the syringe. The piston was pushed down and the milky-white liquid was expelled back into the alien. Gretchen watched, still frightened by her slip, but her fright turned into queasiness as she watched the alien jab the syringe again and again into its body to suck up a little bit of its insides, then squirt them out again. It soon tired of the toy and handed the syringe back to Gretchen.

`Syringe sucks.

Gretchen looked in the syringe. It was empty. She persevered.

"Could I please have a specimen?" she asked, extending the syringe toward the whale-sized creature. There was a pause as Jill translated.

`Yes,` came the reply. `Do not need cut or suck.` The alien extended a tendril toward her. As Gretchen watched, a portion about three centimeters back from the tip necked down and pinched off, leaving a milky sausage floating in the water. She pulled her floating specimen bottle in by its lanyard. Opening the flip-top, she approached the sausage and tried to push it into the bottle with her glove. The small speck of white stuff became agitated and emitted a shrill cry. Changing shape in random patterns, it clumsily swam out of her reach. Gretchen tried to catch it, but it swam back to the large blob that it had come from and buried itself into the surface, rejoining its lost protoplasmic family.

`Stop!` came the alien command through her imp. Another tendril formed and this time the tip of it was inserted in the specimen bottle before the arm necked off. The tendril backed out of the specimen bottle, and Gretchen quickly closed the flip-lid and the sausage-specimen was trapped.

Gretchen, holding her prize in one hand, pulled on her safety rope with the other and soon was gliding back through the icy water to the airlock in the side of *Dragonfly*. As she moved, the specimen bottle started to scream like a tiny baby being flayed alive by a sadistic savage.

Gretchen entered the airlock and was about to close the outside door when she stopped. She held the specimen bottle up in front of her face and watched the little white cloud inside. Now that she had stopped moving, the screams from the bottle ceased. They were replaced by tiny whistles and pings. The tiny cloud seemed to shift in shape and acted as if it were exploring the confines of the bottle, especially the hinge and lip of the flip-top.

"Are you sure White Whistle understood the meaning of 'specimen'?" she asked her imp.

"I requested a small, non-important subset of the set that composes White Whistler," said Jill. "Through our discussions on logic and mathematics we have developed very precise joint understanding of the words 'small' and 'non-important'. I am also fairly sure from its response that it understood the term 'subset of the set that comprises White Whistler.' "

"The reason I ask is that this specimen acts more like a miniature alien than a chunk of flesh or blood. Are you sure this is just a sample and not a baby?"

"I will try to find out," said Jill. "However, we have only conversed about mathematics, logic, physics, and local items that we could both jointly observe. We have not gotten into more esoteric subjects such as philosophy, physiology, and reproduction."

Gretchen heard the front of the plane start to whistle.

"You are big and white," Jill beamed at the white blob.

`Correct.`

"There exists a little white thing in bottle."

`Correct.`

"Is little white thing a subset of you or a small set similar to you?"

`Both,` came the bewildering reply.

"How can it be both?" asked Gretchen.

"I probably asked the question in an ambiguous way," answered Jill. "Let me try another tack."

"As time increases will little white thing become another you?"

`No. Too small. Be eaten.

"Well, I guess that answers one question. It is certainly not a viable baby because of its small size, even though it is a miniature copy of the main body. There must be a minimum mass needed to have a self-aware nervous system, although I don't see any obvious concentration that would indicate a brain."

"It must be distributed," said Gretchen. "How do they reproduce?"

"I'll try to find out," said Jill through the imp.

"You are element, large, intelligent, and white. Loud Red is element, large, intelligent, and red. The set containing Loud Red and White Whistler is a set whose elements are named what?" asked Jill. There was a short whistled reply that Jill had not heard before.

"I'll just assume that response is the collective pronoun. Unless you have an objection, I will just translate it 'flouwen,' from the Middle English word for flow."

"That's fine by me," said Gretchen.

"Exist there other elements in the set of flouwen?" asked Jill of the patiently waiting white cloud.

`Many,` came the reply.

"As time increases, exist there new elements of the set of flouwen?"

`Yes. New elements small. Increase in size until like existing flouwen.`

"So they do have children," said Gretchen. "But how do they make them?"

"It may be a subject that they don't want to talk about," said Jill. "But I'll try."

"Is new element a subset of one flouwen or is new element a union of subsets from two flouwen?"

`Not one. Not two. Dark soon.` The white cloud swam off into the ocean and soon was lost in the gloom.

"It didn't seem particularly bothered with the idea of discussing sex," said Gretchen.

"It didn't say anything about sex," reminded Jill, ever logical. "It just said that it didn't bud and it didn't have relations with someone of the opposite sex."

"Then how do they make babies?" asked Gretchen.

"Perhaps some day we'll find out," said Jill matter-of-factly. "Do you want the Christmas Branch to help you with the analysis of the specimen?"

"I've been outside quite a while," said Gretchen. "I think I'd better get some food and a nap first. Have the branch store the specimen in the climate control freezer. I'll look at it tomorrow when I'm fresh." She cycled through the lock, hung up her suit, and went to the galley. David was at the computer console. She saw he was working with Jill on studying the structure of the whistles and sounds that the flouwen used as language. It seemed to be a very complex language, somewhat like spoken Chinese, where the same sound pattern would mean different things depending upon the relative pitch and its position in the phoneme group that made up each complex word.

"How are you and the aliens doing with the language lessons?" Gretchen asked Jill the next day. "I've got some questions I'd like to ask."

"We're doing very well, Gretchen. They are very intelligent creatures. They learn much faster than humans. They make fewer mistakes than humans. They almost never forget, unlike humans "

"That's enough! Next thing you know you'll be telling me that they have higher IQs than we do."

"They *do* have higher IQs. I would estimate that their IQ is greater than "

"I *don't* want to know!"

"Yes, Gretchen."

"Can you converse with them enough yet to ask them about the other fauna and flora in the sea?"

"I'll ask Loud Red."

There was a singing sound from the radome at front of the *Magic Dragonfly*, and an almost immediate reply from the red cloud in front of the plane. The imp on Gretchen's shoulder translated both sides of the conversation.

"Exist there others, not similar to you? Smaller than you?"

Yes! Lots! I show you?

"Yes, please," said Jill.

What mean 'please'?!?

Jill, who had yet to get across the concept of politeness to these very direct, almost busybody creatures, decided to bypass the question.

"Negate previous statement. Yes. Show us."

The red blob, not bothered a bit by Jill's refusal to answer its question, gave a piercing whistle that carried far out into the deep ocean. After a few seconds the imp on Gretchen's shoulder whispered.

"Look at 10 o'clock low." There was a burbling sound as Jill adjusted trim and the cockpit windows dipped beneath the surface of the ocean.

Gretchen swiveled her head and looked out the left cockpit window. Near the ocean bottom was a long orange snake-like creature, propelling itself rapidly through the water with a sinuous motion of its long narrow body. It shot up toward the surface, contracting in length as it did so. As it approached, Gretchen could hear the creature emitting short sharp sounds, like a yipping puppy, although its size was more like that of a St. Bernard. The speeding orange missile hit the red alien amidships, diving at full speed into the depths of the reddish cloud. There was a reaction and the

orange creature, now nearly a sphere, was thrown out. It was immediately grabbed by thick red tendrils emerging from the main portion of Loud Red. There ensued a wrestling match, loud bellows being interspersed with happy-sounding yips.

"George! David!" Gretchen hollered over her shoulder. "You ought to come see this. Oh! Here come two more!"

George hopped into the co-pilot seat and David stood behind them on the flight deck as the three watched the next two orange snakes speed through the water to join the wrestling match. The three orange blobs kept the red cloud busy. Sometimes one of the orange creatures would be flung off into the water, where it would spread out from a sphere to a sheet, rapidly come to a stop in the water, then swim back into the fray. After a few minutes the fracas quieted down, with the orange blobs just rubbing slowly back and forth against the surface of the huge red cloud and making small busy noises.

"They look like cats or dogs rubbing up against the legs of their owner," said George. "Do you think they're pets?"

"Three orange things are elements of what set?" asked Jill.

Three orange things are— The sentence was completed with a complex whistle that Jill did not attempt to translate.

"Belong to you?" asked Jill.

Yes. Help catch food. Pet. This time Jill felt sure enough of the meaning of the whistle to translate it for the humans.

"Pets know numbers?" asked Jill.

The response to Jill's question was a terrible high-pitched scream that continued as the red cloud literally turned itself inside out. The portion of Loud Red nearest them pushed deep into the center of its body and burst out the back end, dragging the rest of the body around with it. It split into an opening flower and continued back around, shaping the convoluting body into a twirling ring of red smoke. The screaming activated the orange pets and one of them snaked through the opening in its master's body, yipping as it went. The rotation complete, the smoke ring collapsed, and the screaming subsided as the alien took its normal fat cloud shape. Jill, hearing the shocked responses of the humans, reassured them.

"I'm pretty sure that reaction is their equivalent of a laugh. When one of them first did it, I thought that the question I asked had violated one of their taboos and they were mad, but it only seems to happen when I ask a stupid question."

One pet only, but it very smart. Know One and One is Two! We show you!

The red blob whistled to his pets. One of the orange spheres swam around in front, right between the red alien and the *Dragonfly*. A red tendril snaked out to stand over the orange pet. The red tendril bobbed up and down as the alien spoke to its pet.

One plus One is .

:TtWwOoooo: howled the pet, doing its best to imitate the flouwen speech pattern. Jill thought it had done a respectable job.

"I wonder how much more it knows?" asked David quietly. "It must be interesting having a semi-intelligent pet."

Two plus Two is . continued the alien.

:TtWwOoooo: came the reply, and the high-pitched scream startled the humans again as Roaring*Hot*Vermillion laughed again at its favorite joke, its body contorting in its mirth. For a brain that was so rigorously attuned to the perfect exactness of mathematical logic, the pet's completely illogical statement struck it in the same way that a outrageous pun did a literate human. The laughter finally subsided.

Pets not know numbers. Pets not know words. Pets DUMB!

"I want a sample from the pets too," said Gretchen. "See if you can't talk Loud Red into letting us have a piece of one of his dogs while I get into my suit."

"Let me go," said George. "I need the exercise."

George climbed down from the co-pilot seat and, squeezing past David, made his way back to the rear of *Dragonfly* while Jill talked to the red cloud. Gretchen followed to make sure George buttoned all his buttons and zipped all his zippers before he went outside. Soon a thoroughly checked out George was cycled through the lock with a sample bottle and a video camera, while Gretchen, carefully reading through the check list on the door, prepared the airlock for its next use.

George adjusted his buoyancy so that he could sink to the bottom and plod slowly through the water to the front of the plane. It was a long walk through the muck to the front of the 30-meter-long airplane. He saw many rocks and what looked like coral formations around some fuming vents. As he approached the front of the plane where the red alien was conversing with Jill, he passed by an extremely large dark-grey rock.

Hi! said the red cloud, as it spotted him plodding out from under the wing of the airplane. Loud Red came over to greet him. In one tendril it carried a tiny piece of orange stuff. Knowing what to do, the alien grabbed the specimen bottle from the human and, careful not to yank the lanyard tight, opened the bottle and inserted the struggling sample of orange pet.

I put in bottle! Big pets dumb but listen. Little pets too dumb to listen.

"I notice that it doesn't call it a piece of pet, just a little pet," said George to his imp, as he felt the three orange blobs gather to nuzzle him all over. He felt like a stranger in his first visit to a home with a pack of curious hunting dogs. Fortunately his suit protected him from the "wet noses" of this pack of hounds.

"They seem to be built along the same lines as the aliens," said Jill through his imp. "They are completely amorphous, and any small segment is just like the original, just diminished in capability."

Loud Red gave the specimen bottle back to George, then swam back to the front of the ship to continue its conversation with Jill. George tucked the bottle away on his belt and, hefting the video camera, moved forward to take some pictures of the red alien and his orange pets with *Dragonfly* in the background. Arielle and David in the cockpit looked like air-breathing goldfish in an inside-out aquarium.

BOOM!!!

George was rocked by a concussion through his suit. Overhead, shooting

through the water at great speed, were heavy grey rocks trailing streamers of smoke. The rocks fell to the bottom some 60 meters away. The streamers settled to the bottom rapidly, as if they were being driven through the water by internal contraction rather than floating down in the low gravity. There were many of them and three touched George. The streamers were sticky, and the minute the threads felt George move they began to pull in their far ends to contract and wrap themselves about his body. Within seconds his arms were pinned and he found himself falling backward into the muck. The next thing he knew there was a grey film over his visor. It grew thicker. He was in blackness.

David had been looking in the right direction and had seen the grey rock explode. Hundreds of fragments of rock shot through the water, trailing grey threads behind them. Some of the rocks struck the hull of *Dragonfly* with a thud and fell to the bottom. There was a slam from the back of the plane, a pounding of large hands and feet on the walls and floor, and a large hard-breathing body stood on the flight deck between David and Arielle.

"What happened!" gasped Gretchen.

"A rock exploded and has thrown out a net of grey strings. They're falling down now."

"Look!" said Gretchen. "The alien and his pets are swimming upward at the threads and slipping through the gaps between them."

"The threads are falling awfully fast," said David. "Like they were being pulled down. The rock must be pulling in its net."

"George!" yelled Gretchen. "He's out there somewhere!" She leaned over and peered out the side cockpit window. She saw a struggling grey blob. It rolled over and a specimen bottle bobbed free and floated up to the end of its lanyard. Feeling the motion, the greyness climbed the rope, surrounded the bottle and pulled it back down into the grey mass.

"IT'S GOT GEORGE!" screamed Gretchen, jumping down from the observer's seat and running back down the corridor to the suit lockers. David followed to check her out, but by the time he had made it to the galley, he saw that Richard had gotten out of his bunk and was looking around at the excitement with bewildered eyes.

"Richard!" David commanded in a tone that no one had ever heard him use before. "George is in trouble outside. You suit up with Gretchen and go out to help." He turned to meet Arielle coming from the front.

"There if grey ftuff over window," Arielle reported.

"Then it's probably all over the plane," David said, "including the door to the airlock. If we open the door, it'll probably creep inside and jam the lock." Gretchen and Richard halted the suiting-up until they could figure a way out of their predicament.

The red cloud, its orange spheroids strangely quiet and nestled close to its body, slowly floated back toward the plane, keeping a safe distance from the nasty grey threads still falling on *Dragonfly*. The Gray:Boom got more than it had bargained for this time, but it was too stupid to realize that it couldn't eat its metallic prey. Floating:Rock was covered with the sticky grey film, but it could still talk.

Roaring*Hot*Vermillion then noticed a wiggling bulge. The Gray:Boom had caught one of the Floating:Rock's pets. It couldn't eat that either because of the hard suit (Roaring*Hot*Vermillion had tried tasting one of the humans when they had first met—*Nasty!!!*) Unless the big creature did something, the pet would be stuck, however, for the grey threads were very persistent and very sticky. Roaring*Hot*Vermillion swam down to the front of the airplane and hollered at Jill's sonar through the grey film.

You yell!?!

"Yell?" queried Jill.

Seeing that Floating:Rock would not or could not do anything about its struggling pet, Roaring*Hot*Vermillion roared to the rescue. Its huge bulk surrounded the struggling figure wrapped in sticky grey. There was a piercing shriek. The grey mass parted under the sonic barrage to show the head portion of the human spacesuit. Two more shrieks and the grey mass had dissolved into a sonically disintegrated grey cloud. George was free. Jill tried frantically to converse with him through his personal imp, then with his suit imp, but there was no response.

George headed for the airlock, jumping gingerly over the grey strands that still lay buried in the muck. It took him a number of minutes to make his way back and he was wondering how he was going to get past the grey film covering the airlock door when suddenly a clear spot appeared. A few more seconds and the spot became an oval as the grey film retreated. George reported what he saw, but was bewildered by Jill's lack of response through his imp. Something must have happened to the sonar system during the explosion that had caused the grey thread problem.

George's running commentary helped Jill focus the sonic efforts of the branch in the airlock, while she repeatedly attempted to contact George through her various links. Nothing seemed to work. Then Jill suddenly realized something. She signaled some special commands to her imp.

Punch-punch-punch. Pinch-pinch-pinch. Punch-punch-punch. The twinges on George's neck finally got through. The imp was signalling to him in Morse code!

"SOS!?!" he said.

Pinch-punch-pinch-pinch. Pause. Punch. Pause. Punch-punch-punch. George didn't really remember what dash-dot-dash-dash stood for, but if it was followed by E-S, there was no doubt in his mind that it was Y as in YES rather than N as in NO.

"I'm DEAF!" he hollered. For the first time since he was freed from the sticky grey threads, he noticed that he was lacking the usual feedback through his auditory system.

Pinch-punch-pinch-pinch. Pause. Punch began the imp.

"Enough!" hollered George. "You'll make me black and blue! There's still some grey near the lower left corner of the airlock."

As he said the words, the grey film in the lower left retreated under the sonic bombardment from the branch inside.

"All clear!" said George. The lock slowly opened, and George, bending his knees in the muck, took a flying leap at the opening overhead and sailed in

with only a little steering help from the branch at the door.

Safely inside, George wondered why the branch didn't close the door immediately, then realized that it was using its sonic capability to clear the area around the hatch from the grey menace. When the branch finally returned and activated the airlock cycle, George noticed that most of the upper portion was missing.

"Out hunting grey spooks," he murmured to himself—suddenly annoyed that he couldn't hear what he had just said.

The outer lock closed and he was left in the darkness with the decapitated branch. He turned and forced his faceplate close to the small porthole that looked into the inner portions of *Dragonfly*. It seemed strangely dark, like a grey film was over the window. His bruised eyes finally focused and stared into a pair of beautiful blue pools of concern, surrounded by hands that blocked off the outside light to peer into the deep darkness inside the airlock.

The blue eyes jerked aside and a glaring torch burned into his abused eyeballs. The glare was as painful as the blast of sound that had somehow freed him. The lock was finally purged of the icy-cold ammonia-water mixture and George stumbled through the inner door into the warm and friendly interior of *Dragonfly*. He closed his aching eyes and relaxed his exhausted body, letting it dangle in the firm grasp of Richard while Gretchen carefully pulled off his suit. He could hear nothing, but could feel the throb of Richard's jugular through the back of his neck. There was a light touch at one of his ears. He turned his head and peeked through slitted eyelids to see a bloody piece of cotton wielded by a concerned-looking Arielle. He was asleep before they got him to his bunk.

George had to use sign language for a day before his hearing started to return, and ever after the ear tests done at his annual physicals showed a large dip in sensitivity at the higher frequencies. In the left ear, the dip had been caused by his membership on the ROTC rifle team in college. It was now matched by a dip in the right ear caused by the cannon blasts from the red cloud that had saved his life.

Gretchen made her way back to the Christmas Branch's work area. She tiptoed past the bunk containing the sleeping George and softly closed the privacy curtain behind her. The Christmas Branch was waiting for her.

"Where are the specimens?" she asked. The branch telescoped down to dwarf size, opened up a small door in the work-wall, and pulled a bottle from the freezer. Its fingers interrogated the container with a blaze of varicolored laser light as the hand reached up to pass her the bottle.

"This is the white one. Careful! It's very cold."

It *was* cold. Gretchen juggled the bottle in her hand until she could hold it by the short plastic loop that connected lid and bottle. Her fingers soon warmed up the plastic and she could hold it up to her eyes.

"It doesn't seem to have changed any," she said.

"No significant change in the creature, but the spectral response of the

water shows the presence of molecules that were not there previously, probably metabolic wastes."

"I'll take samples of both the water and the specimen," she said. "Give me the syringe."

She tried to hold the bottle while she jabbed the needle through the rubbery seal across the opening of the container, but the cold was too much for her fingers. She gave up.

"Here," she said, handing the bottle to the Christmas Branch. "You hold it while I get the samples."

Gretchen took the syringe and, pushing the tip of the needle through the seal, she extracted a small sample of the ocean water. As the needle came out, she smelled an astringent whiff of ammonia. She went over to the wall to a tiny physical and chemical analytical lab. Not much larger than a common brick, it could do a complete inorganic and organic analysis on a single drop of sample. It also had a barrage of manipulators and microscopes that could take apart and examine any portion of that drop.

Gretchen gave the analyzer the droplet, and Jill started the machine running while Gretchen turned back to the branch. The needle went back through the seal and, after squirting out the remainder of the water from the syringe, Gretchen started trying to catch the elusive blob. There was no room to hide, and soon Gretchen had a syringe half full of screaming white jelly.

Gritting her teeth, Gretchen went back to the wall, waited until the green light signalled that the analyzer was ready for another sample, then inserted the end of the needle into the input port and gave a tiny squeeze. Still clenching her teeth, she turned back around to the bush and squirted the remainder of the syringe back into the specimen bottle, where the tiny blob quickly rejoined the larger white sausage.

"When the white alien returns, please take this outside and give it back," she said. "I won't be able to sleep for the screams coming from the freezer."

"The freezer is well insulated," said Jill. "I'm sure that no noise could get out."

"No noise, but I would still hear the screams," she said, handing the syringe back to the Christmas Branch and heading forward to the science console, where the information from the physical and chemical analysis lab was building up on the screen.

As Gretchen sat down at the console, Jill started talking to her through her imp. Gretchen could almost swear that the computer was excited over the discoveries that were being made in the brick-sized laboratory at the rear of the plane.

"The structure of the White Whistler is identical to that of those strange rocks that Sam found on Roche and Richard found on Hawaii," said Jill.

"But those were crystalline rocks," objected Gretchen. "These animals are more like intelligent jellyfish."

"But the basic structure is the same," said Jill. "The entire sample of White Whistler contains nothing but tiny dumbbell-shaped units, large cells if you like, arranged in interlocking layers, with four bulbous ends around each necked-down waist portion, two going one direction and two going the other so that the whole body is an interlocked

whole. The units are larger than in the rock samples, but I suspect that is just because they are bloated up with water."

The rocks *were* hygroscopic," reminded Gretchen. "Can you do a chemical analysis?"

"It's almost done," said Jill. "The inner portion of each unit is the same silica gel-type compound that was in the rocks, but with some of the bonds hydrated. The outer white covering is much more complex, a thin film of molecules made up of ring compounds that repeat in semi-random patterns. There are twelve basic molecules that are arranged in large plates held between layers of a liquid crystal-like substance."

"Do you find any structure in the central gel portion?"

"Not much. They are practically crystals in their order, although quite flexible because of their high water content."

"Then the gel material must be their equivalent of bones. They determine the basic arrangement, while the thin film covering the 'skeleton' is both the nerve tissue and the genetic code," said Gretchen.

"That might not be correct," said Jill. "There is evidence that the outer surface of the gel dumbbells have patterns on them that seem to fit the twelve basic compounds. Perhaps at some stage they act as a template for ordering the compounds into viable sheets."

"What is the liquid crystal material for?" asked Gretchen.

"I am not sure of its purpose," said Jill. "But it *is* the source of their bright color."

"We have a specimen from Loud Red's orange pet," said Gretchen. "Let's take a sample of it and see what the difference is."

"I will have the Christmas Branch insert a sample into the laboratory," said Jill. "Meanwhile, I wanted to show you something. I am now using my micromanipulators to tease apart the tiny sample of White Whistler that you inserted."

Gretchen watched on the screen as the droplet was attacked with some rapidly moving needles. The drop was divided in half. Each half squirmed off, trying to escape the needles. The manipulators caught one and carefully pried it apart. For a fraction of a second there was a torn-looking edge, then each white fragment reformed into a long thin slug and tried to swim away. One was caught and carefully divided again. Finally there was just one dumbbell-shaped unit, flexing its thin waist in an attempt to move through the water.

"No further subdivision is possible," said Jill.

"But they're still huge compared to a cell," said Gretchen. "They're more the size of a red ant."

"I have just completed the preliminary analysis of the sample of the orange pet," said Jill. "The basic unit is the same as in the intelligent aliens, but the patterns in the orange-colored thin film are less complex than in the white film."

"Try an experiment," said Gretchen. "Let the small blob of white 'eat' a single unit of orange, but put a tracer in the orange one so we can retrieve it later."

A tiny single orange unit cell was teased away from its comrades and

transferred into the holding tank for the white specimen. It was quickly caught by the larger white blob.

"The orange cell has been absorbed," said Gretchen, "But it's fighting back. Look, there are now two orange units. Will the lower animal take over?"

"You didn't notice the holding action taking place at one end of the 'captured' white unit," said Jill. "See the densification of the white at the end of one sphere? Now notice the counter-attack on the original unit. The orange forces, in their attempt to take control of an adjoining unit, have spread themselves too thin for an adequate defense."

The miniature battle was over in a few milliseconds—the action being slowed down for the human.

"Now tease that same unit out," Gretchen said, then added in a worried voice, "I don't see any tag in it. Did you inject a tracer?"

"There was no need," said Jill. "My sensors have a complete three-dimensional view of the entire arena. I just kept an 'eye' on it."

The victorious white blob was pulled apart, and its recent capture wrested from it. The unit was subjected to analysis.

"Almost one-fourth of the unit has been modified on the surface to match the surface markings of the other white units, while the remainder has the old orange markings," said Jill.

"Well. That's certainly a simpler way to eat than breaking all the proteins in your food down to amino acids and rebuilding them from scratch again just to change the protein's loyalty," said Gretchen. "That must make for a strange culture. Everybody can eat everybody and the only thing that gets changed is the ID number. Unless the flouwen get badly damaged in an accident, they never die."

"But the units do die," said Jill. "Three of the white units have lysed in the past few minutes. They also regenerate themselves. Two units have reduced their waist to zero, and the two resulting spheres have necked down to form new units. The statistics are not good, but I suspect the average lifetime of the units is only a few days."

"But the flouwen live much longer than that," said Gretchen.

"Yes," said Jill. "From my conversations with them I get the impression that those we know have lived many hundreds of human years. There are others, off on long-term research projects, that are much older than that."

"But how can that be?" said Gretchen. "We may replace most of our body cells in seven years, but the complement of nerve cells we have at maturity is all we get."

"That's because the cells in an Earth animal are specialized," said Jill. "These aliens are not built that way. They are organized more along the lines of a colony of army ants or a swarm of bees. Each unit is large and can live and reproduce as an independent entity, but when they swarm together, they become more than a sum of the whole."

"An intelligent being—that is nothing but a programmed collection of wet gnats," said Gretchen.

"But with an IQ of

"I DON'T WANT TO KNOW!"

"White Whistler is back and asking

questions," said Jill. "Is it all right to return the rest of the sample?"

"Yes," said Gretchen. "The last thing I want is a batch of ants in my refrigerator." She poked at the screen with short jabs of her finger, slightly annoyed with herself for getting perturbed with Jill. She bit her lip and tried to concentrate on the less spectacular, but equally scientifically important chemical data that Jill had extracted from its analyses of the metabolic wastes in the water from the sample bottle.

The night was long, for they were beginning to enter the inner pointed hemisphere of Eau. Gretchen finally quit after the screen started to fuzz out in front of her eyes. She swiveled in the science console chair and went to the galley. After all that work, she felt she deserved a treat and asked her imp for one of her special gourmet meals. They were only allowed one per week but Gretchen still had a two-week reserve after days of refueling on algae burgers and protein shakes. The gourmet meals had been prepared months ago back on *Prometheus* and frozen until they were called for on the *Eagle* or *Dragonfly*.

Gretchen punched up her dinner. Liver from "Chicken Little," one of the tissue cultures treasured back on *Prometheus*, smothered with cooked real onions; frozen real broccoli with mock Hollandaise sauce; new potatoes in pseudo-cream sauce; and real strawberries in pseudo-port for dessert. It would take some time for the meat and vegetables to warm up, for Jill would program the microwave to bring everything together at the same time without overcooking or drying out. Gretchen went back through the privacy curtain and went to the head. She returned refreshed as the galley motiles were arranging her dinner on the counter, a cloth napkin adding counterpoint to the utilitarian stainless steel utensils. Jill certainly knew its human psychology.

Gretchen's galley counter stool was next to the computer control center. A red-bearded David Greystoke was still at his console. Gretchen picked up a sprig of hot broccoli dripping with Hollandaise sauce and leaned over to hold it in front of David's eyes.

"A bite of broccoli for a preview of Eau-3," she said.

David's gaze broke from the screen, his red-rimmed eyes matching well the red-rimmed stubble below his chin. He finally recognized who had spoken to him. He grinned and lunged.

"Done!" he said, speaking through green teeth. "It's time I went to bed anyway. Here, take the earphones."

Gretchen took the glowing headset imp and put it on. David keyed his console, then rose and headed for the crew quarters in the rear. He was too tired to eat. He would do that when he woke up.

With the computer console vacated, Gretchen slid into the vacant seat and placed the tray of succulent liver and onions on her lap. Then with her right hand holding a battered stainless steel fork and her left hand holding a crystal goblet full of strawberries and port, she let her senses relax and partake of a gourmet trip through the colorful seas of Eau. Seas as seen by the magical imagination of David Greystoke and his computer. It was only when she realized that her last bite of liver and onions was stone cold that she knew she should be

going to bed. The rosy red dawn was glinting through the right science blister when she rolled her fresh-washed body into her lower bunk and fell into a delightful sleep.

MATING [redacted]

The next day Gretchen finished her breakfast and her exercises, took Jill and the Christmas Branch through a complete systems checkout, and was ready for the morning. She came forward and perched on the corner of the co-pilot seat.

Arielle was sitting quietly in the pilot seat, as she had been for the past six hours. Her hands were folded in her lap, but she was looking out the window over the lapping waves that broke over the nose of the airplane as it chugged its way slowly through the calm seas. On her screen was Jill's sonar vision of the underpart of the ocean as seen through the makeshift sonar array. The efficient, calm pilot eyes switched automatically from screen to windshield to instruments, never distracted, never straying from their appointed rounds of instruments, screen, windshield, instruments . Gretchen waited until the glance was on the instrument panel, then spoke.

"I'll take it for a few minutes if you want to rest," she said. "From what Jill tells me, the aliens will be back when it's light, and they have promised to show us something. Why don't you take a break while there's time?"

"Thanf," said Arielle. She grinned, the glittering lights from the imp-brace in her mouth putting a sparkle in her smile. She hopped down on the flight deck and made her way back through the plane, talking quietly to her imp as she went through the privacy curtains to the crew quarters. In a few minutes she was on her way back. She picked up three chunks of protein cheese, two algae shakes, and four energy sticks at the galley and made her way back to the cockpit. Looking bright and fresh, she hopped back into the pilot seat. She gave a bright "thank-you" grin to Gretchen, her still puffy lip looking better under a fresh patch of Neuskin. While Gretchen watched enviously, she took a huge bite of protein cheese and washed it down with a slurp of an algae shake that almost emptied the cavernous metal container. Nibbling thoughtfully on an energy stick, she resumed her automatic scan of her pilot's empire, downtrodden though it was.

Gretchen, watching the performance, wondered where Arielle had found the time to put on eye makeup and a Neuskin patch in the few minutes that she had been away. But perhaps it wasn't makeup, just dark lashes surrounding a dark, belladonna eye. Sighing, Gretchen got up and took the science-scan instruments through their routine. Designed for airborne work, they had required some modifications to make them suitable for scientifically accurate underwater surveys, and frequent recalibration was needed.

"The flouwen approach," said Gretchen's imp. She turned and glanced at the radar screen that she and the Christmas Branch had modified for sonar. There were some blue blobs in the upper portion of the screen. Blue meant "blue shift," which meant that

the aliens were coming at them very rapidly.

"Do they sound familiar?" asked Gretchen, a little concerned.

"It's Loud Red, White Whistler, and another one. There is also evidence of other moving object at extreme range, off the screen."

Gretchen noticed that the imp on Arielle's shoulder had been giving her the same information. Arielle whispered a few words, her hands still folded quietly in her lap, and the dull throbbing sound of the slowly rotating propellers stopped. The nose dipped and the plane sank slowly in the water as the aliens approached. By the time Loud Red, White Whistler, and the new green-colored alien came into view, they could be seen through the cockpit windows, illuminated in the dawning sunlight augmented by the powerful landing lights in the nose and wings of *Dragonfly*.

The red cloud arrived first, booming loudly.

I won! I won! I got here first!

`So you did, Roaring*Hot*Vermillion. Now shall we wait for Bitter#Green#Fizz?`

That slowpoke! Too many Pretty:Smells! Bitter#Green#Fizz leave Pretty:Smells behind—move faster!

The red cloud flared out as it approached *Dragonfly* and slid underneath the silvery-smooth hull of the long fuselage.

"Whoops!" said Gretchen, thrown upward by the wave of red passing under the airplane. She came down like a cat and heard confused noises from the various parts of their compact universe as Jill reassured all the crew members that what felt like a tidal wave was only Loud Red being playful. Carefully maintaining a three-point hold on carpet and bulkheads, Gretchen made her way forward to join Arielle at the front of the aerospace plane.

The sunlight was getting brighter as Gretchen hopped into the co-pilot seat and looked out at the huge billows of red and white swimming languidly around *Dragonfly* like whales around a tourist boat. Periodically Loud Red would scratch its "back" against the bottom of the plane, heaving it up slightly with its massive bulk. Its spheroidal orange pets would imitate the motion, adding three little bumps to the one big heave.

"Here comes the other flouwen," said Jill, a computer-generated ring of red flashing on the sonar screen in front of Arielle to indicate a rapidly moving speck emerging from the distant background clutter.

Arielle peered off into the distance and soon her acutely trained pilot eyes were able to see the figure.

"Thif one'f emerald. How pretty!"

White Whistler kept to its slow figure-eight motion about the plane while Loud Red and its pets bounded off at top speed to welcome the newcomer.

HI! HI!! HI!!! came the roaring greeting as Roaring*Hot*Vermillion streaked under Bitter#Green#Fizz. Coming to a stop, it turned and took up station next to the smaller green cloud as they both made their way back to the airplane. Its Orange:Hunters had come to a stop some distance away, but were now moving in closer to get a better taste of the water around the green stranger. Finally satisfied, they went

back to their trailing positions behind Roaring*Hot*Vermillion.

#I got your call, and came as fast as I could. Have been traveling all night.#

You hungry!?!

#Yezzz!#

Roaring*Hot*Vermillion issued a series of sharp whistles, and the three orange spheroids took on their snake shape and slithered out in a pattern that swept the ocean off to the left. They nosed under every rock formation and soon jumped a yellow-orange rogue. It was slightly larger than they were, but they were faster. The three hunters, working as a team, worried the rogue around in a circle. Once they had it moving in the right direction, they stayed behind it and drove it back toward the airplane and their master, who had spread itself out like a trip-net on the ocean bottom. To one side was a wall of green, on the other side was a wall of white. There seemed to be an escape hole between the two walls at the end of the narrowing funnel. The rogue streaked between the moving walls with the Orange:Hunters close behind, then screamed as a multitude of red fingers shot up from the bottom to entrap it in their python-like grip.

#Simply delicious!# buzzed Bitter#Green#Fizz as it methodically pulled the still struggling chunk of rogue into tiny pieces and absorbed them into its body.

Yeah! agreed Roaring*Hot*Vermillion, as it pulled some chunks off its half and threw them toward its trio of orange pets, who snapped them up avidly. It stopped feeding them when they started to play with their food instead of eating it.

It tore off a huge chunk and offered it to Clear`White`Whistle, who had helped form the trap.

`Not hungry.

OK! I eat! and large screaming masses of orange-yellow flesh were ripped from the remainder of the rogue and gulped into the red body, where the enzymes of Roaring*Hot*Vermillion soon won the lopsided battle against the outnumbered enzymes of the rogue.

With its hunger satiated, Bitter#Green#Fizz started to ask questions about the airplane still off in the distance. It finally grew brave enough to come near *Dragonfly* and converse with Jill through the sonar, but it really wasn't interested in the humans, and refused to come up to the cockpit windows and "look" inside with the lens that Clear`White`Whistle had invented. Instead it stood off at a distance, rocked up a good portion of itself into a large emerald boulder, arranged the rest of its body into a mushroom-shaped cloud hanging above the rock, and unrolled the collection of Pretty:Smells it had been carrying.

As the wings of the first Pretty:Smell began to wave, the Orange:Hunters streaked forward, only to be met by expert slaps from three green tendrils that emitted a bitter smell along with the stinging slap. The Orange:Hunters went back to cower behind their master.

The Pretty:Smell unfurled its two-meter-wide wings and started to flap them slowly in the upper reaches of the sunlit water. The wings were ablaze with iridescent colors flashing out in multicolored gleams from the arrays of liquid crystals inside its body.

Both Roaring*Hot*Vermillion and

Clear`White`Whistle sent up long feelers to catch the complex interplay of the flashing lights, the delicate aroma, and the high-pitched trilling melody coming from the Pretty:Smell. The Pretty:Smell was soon joined by six others, and the three aliens seemed to go into a trance as they admired the bird-like creatures.

"What's going on now?" asked Gretchen of her imp.

"It's hard to say," answered Jill. "The three of them obviously caught some food animal, but except for its color, it looked just as amorphous as the flouwen and their pets. The new creatures are also obviously pets of the green flouwen. I'll call that one Green Buzzer because of its husky 'voice.' The pets are different in structure though. They seem to have wing bones and a spine that ends in a tail. They look like translucent pterodactyls with hummingbird features."

"I'm going out to get some pictures from close up with the video camera," said George. Gretchen jumped down from her seat and headed back to check out his suit.

It was about an hour later, when Barnard was rising high into the sky, that the next alien, Warm@Amber@ Resonance, hummed into view. It was greeted by a pack of curious orange snakes, who sniffed it over and led it back to the trio of boulders still enjoying the Pretty:Smell concert.

Enough! The red boulder broke up into a clump of red rocks, which dissolved into a red blob.

`Nice. But they need more training.`

#I shall, as soon as my research on the seven-color mapping theorem on the hyper-torus is finished.#

The amber-colored alien joined them.

@I got your call and came. What is the strange hard thing?@

`It's called Floating:Rock. When it was first found, it couldn't talk. But it quickly learned. It cannot move well since it's so hard, but it has things inside it called Stiff:Movers, that can come out and do things. We think the Stiff:Movers are its pets, and they help Floating:Rock like the Orange:Hunters help Roaring* Hot*Vermillion. It seems the Stiff:Movers can't be very intelligent, since they don't talk.`

Want to see them? Come up close and look inside!

@No. Not interested.@

OK!

`Floating:Rock seems to have chosen for its research a study of us,` said Clear`White`Whistle.

@What a strange field. Studying beings instead of mathematics. Could lead to recursive problems in logic.@

`If we studied ourselves, that is obviously recursive, and one could not be sure of the correctness of one's logic. But Floating:Rock, although intelligent, is obviously not we. It might be able to avoid that problem.`

@Possible,@ hummed the yellow one.

`Floating:Rock asked how we made new we's.`

@You told it, of course.@

`I tried, but its language is still limited.`

@Then let's show it.@

`Exactly why we called you. Are you of good bulk?`

@Couldn't be better. Ran into a

swarm of Pretty:Smells on the way. What's that strange thing approaching?@

`That's one of the Stiff:Movers.`

Warm@Amber@Resonance flowed over to George. It put down a few rocks in a ring around George to stabilize its body in the current and examined the human in detail. George stopped moving and held still as he felt and heard the sonar pings echo through his body.

"Is everything OK?" he asked his imp. "The yellow flouwen seems to have me surrounded."

"That's Yellow Hummer," said Jill. "I'm pretty sure you're safe. From their conversation it seems that they think you are a pet of mine and they don't seem to eat pets, even though they are perfectly willing to eat wild animals that are indistinguishable from pets."

"Arf! Arf!" said George. "I wish I had a tail to wag."

A white blob slithered under the yellow curtain and came up to envelop George. He was used to White Whistler swarming over him so he relaxed. White Whistler picked him up and moved his legs and arms around, obviously showing off the "doll" to Yellow Hummer.

`. . and parts of it come off in chunks. But they nearly always maintain a thin string back to the main body.` Tools were unhitched from his belt, pulled to the end of their lanyards, then returned to their proper hook. His video camera was snatched from his grasp and handed back, lens pointing at his helmet. He turned the camera around and continued recording. Finally through the white mist appeared a yellow blob.

`Go ahead. Get right up close to the round part up top. You can't see very well since there is a "nothing" inside, but you can "look" just fine. There is a funny bumpy thing inside with white fuzz on top.`

@Ugly.@

`Isn't it.`

The two aliens swam off, leaving George to capture their exit on video. They rejoined the others.

`Well. Everybody feel good and bulky?`

Yeah! Need to lose some weight. Getting too slow.

@I'm ready.@

#I guess I'm bulky enough, but I don't know. I've never made a youngling before.#

Really!?! Nothing to it!

@But do you really remember your first time?@ chided Warm@Amber@Resonance. @It was a little scary then, wasn't it?@

I'm never scared!

@Well, I was the first time. Especially when I had to 'let go'.@

*Well .That *is* a little scary the first time.*

@We all will go slow, Bitter# Green#Fizz. That will be better for Floating:Rock too.@

The four came together until they formed a circle twenty meters in diameter, each colorful body filling up a quadrant. They floated about two meters off the bottom and let down concentrated portions of their outer perimeter as rocks attached to streamers that anchored them in place. George was able to position himself just outside the ring of rocks and shoot under the canopy of bodies. Gretchen had exited in the meantime and had increased her buoyancy until she floated just below the waves, where her video camera could

look down at the action. The bobbing of the waves made her camera view swing wildly on the screen, but Jill could later compensate the motion out of the middle portion of the picture.

@Hold on at the middle, Bitter#Green#Fizz.@

`Now spiral around.`

#How many times?#

Lots!

@Just keep going as long as we do. We want to make the youngling nice and big so it will re-learn fast.@

#I'm scared.#

`Slow down. Bitter#Green#Fizz is taut.`

"They're making a spiral at the center, like one of those super-large lollypops you buy at amusement parks," said Gretchen.

"It's the same on this side," said George. He swept his video camera around to take in the rocks, still anchoring the aliens on the outside while their inner portions were continuing the swirling motion.

@Let go.@

#I'm losing me!#

You'll feel lots better when you are thinner!

@Let go so we can spiral some more.@

After some more coaxing, Bitter#Green#Fizz allowed more of its body to be pulled into the multicolored whirlpool growing in the center. As its essence was drawn out into a multiply touching thread, it seemed to lose its identity and become one with the others. Yet as its body drained away, the remainder of the multi-ton bulk felt as if it was growing younger.

Bitter#Green#Fizz felt centuries drop from its weariness. It vibrated in happiness.

#Oooozzzzz!#

Aaahh!

@Hmmmmmmmmm!@

`Slowly. Slowly.

`Stop!`

"The spiral whirlpool is now about as big as the rest of them! If that's a baby, it's a big one!"

"It's still a spiral of many colors, Gretchen," said George. "While they are just a single color."

"Wonder what comes next?"

`Now comes the hard part, Bitter#Green#Fizz. Think of your green. Pull the green back without pulling the thread back.`

#But my thread is green. I can't pull the green without pulling the thread!#

Yes, you can! Watch!

From the very tip of the green thread deep in the spiral came the message that the red thread lying next to it had turned pink, then clear.

Then on the opposite side, close-coupled by the spiral twining, the milky thread became clear. Through the thin clear threads could be seen a yellow thread, and soon that became clear, leaving only the green.

`Pull the green back.`

There was a moment's pause as the green thread turned a darker shade.

@The other way.@

Patiently the three mature flouwen held the spiral pattern while they coaxed the younger adult into the mysteries of procreation. Slowly, hesitantly, the green film in and among the cells of gelatin was pulled back into the central body of the emerald-colored individual.

"The central portion is turning clear," said Gretchen, making sure that the video camera was catching the phenomenon.

"You can see the main bodies of the aliens take on a richer color, so whatever it is that makes the color is flowing back into their bodies instead of being destroyed or rendered colorless," said George.

"Now what?"

"Wait and see."

@Good! Keep pulling.@

#It feels so strange. So good!#

It's all that extra green sloshing around inside you!

`The youngling is clear.`

@Now pinch off the thread, Bitter#Green#Fizz.@

Don't let any green leak back in!

The final pinch-off was easy, for the cells in Bitter#Green#Fizz had no affinity for the neutral-clear gel. The four adults separated their respective threads and waited. The lens of spiral jelly merged into an amorphous blob. For a long while it stayed colorless. Then deep within it, some enzyme had taken the bits and pieces of randomized information that were still resident in the mold patterns in the gelatin and had synthesized some nerve tissue. It was a viable pattern, and using it as a template, the enzymes built more and more, and a wave of transparent blue color spread out from the nucleation point until it suffused through the entire multiton glob of floating jelly. The blue blob started to talk. Its first words were stuttered in the varied speech patterns of its progenitors.

@Hello*Hello!#hello!@HELLO!* HELLO@hello:

But it soon developed its own distinctive voice, a blend of four voices into a beautiful warbling tone.

~hello~Hello~Hello. ~Hello!~

@One plus One is Two@ prompted Warm@Amber@Resonance.

~One plus One is TtWwOo.~

@It's going to be a smart youngling.@

Look who made it!

#It has such a pretty blue color, and such a dainty warbling voice.#

~Smart youngling pretty blue . dainty warbling~

#Let's call it Dainty~Blue~Warble!#

~Dainty blue warble~

@Dainty~Blue~Warble it is then. Come youngling. I'll bet you're hungry. Can your Orange:Hunters find us something small to eat, Roaring*Hot* Vermillion?*

"It turned blue before our eyes," exclaimed Gretchen.

"And it already knew how to speak the instant it was born," said Jill, the incredulous tone in the robot voice driven home by the lengthy pauses between the words, as the computer brain alternated high-priority computations with the low-priority task of talking to the humans.

"It must really be a strange form of evolution. They have the advantages of budding, in that the new individual has nearly the same size and intelligence and *memory* as the original individuals, so there is a continuity of experience that must carry back over eons. Yet there is the diversity of sexual interchange, with all the advantages of hybrid vigor," said George. "Did anyone figure out how many sexes they have? Four?"

"I'm going through a detailed analysis of the spiral pattern," said Jill.

"But I can find no significant difference in any of them, except the green one, which was a little slower than the others. I'm not sure, but maybe they don't have sexes, or at least roles where one partner performs a different function from the other. Unlike in the human case, where all the male does is to eject the genetic material while the female must incubate the joint progeny."

George was going to say, and getting stuck in the beginning as well as in the end." But he decided not to.

His camera working constantly, George continued to capture the aftermath of the mating of the four mastodons. The red, white, and green aliens were swimming aimlessly about each other, enjoying each other's company while brushing near the cloud of bird-like creatures that floated in harmonious movement among them. The yellow alien was swimming in slow circles about the pale-blue infant, talking to it, encouraging it to swim, and responding to its warbling speech parttern.

The aliens finally drifted away, having forgotten about Jill and the humans in their preoccupation with each other. George and Gretchen were getting cold, despite the protection of their heated suits, and came in to warm up. George let Gretchen and her camera through first.

As George cycled through, Richard took the heavy video camera from his grip.

"You got feelthy pictures, Signore?" he joked.

"I guess so, but it never seems as exciting when you're looking through the viewfinder."

Gretchen helped George take off his suit, and checked it thoroughly before allowing it to go in the locker.

"Y'know," she said in a tight voice, her gaze fixed on the tell-tales on the chest pack as she punched check-code after check-code into the button array, "to be really fair, we humans ought to be willing to put on the same show for the aliens."

There was a pregnant silence, broken by an indignant explosion from Richard.

"Impossible," he said. "We can't survive outside without suits!"

"It could be done in the cockpit area where they could see in," said Gretchen, her eyes still fixed on the suit readouts. "Have to be done standing up, of course. They couldn't see if we were lying down. The rest of the crew would be in the back, of course."

Gretchen finally looked up. Her eyes met Richard's and she turned beet red.

"Not me!" exploded Richard, his dark copper skin flushing below the ears.

"Do you mean to tell me that squaws are braver than braves?"

"Bravery has nothing to do with it," said Richard indignantly.

Gretchen gritted her teeth and smiled a saccharine smile at Richard. "Fair is fair," she said sweetly. Then her voice turned into a challenge. "I'm game if you are, buck."

Without waiting for a reply from the strangely silent giant of a man, petrified by a fear that was stronger than any he had ever had to face before, she turned her head and talked to her imp.

"Ask the aliens if they would like to see the difference between male and female humans and a demonstration of the reproductive act," she said. "We won't

be able to show them a baby, but at least they can see how it's done."

There was a long pause as the computer interrogated the aliens. Then finally Jill replied. "They aren't interested in humans," it said. "As far as they are concerned, you are just unintelligent pets of mine. Instead they want me to tell them why I have wings that look like the wings on their bird-like pets, yet I obviously don't swim with them."

There was an outrushing of air from Richard's lungs.

Gretchen smiled and winked at him. "Well, I guess it'll have to be some other time, handsome." She hung up George's suit, brushed past the still-shocked Richard and went forward to the galley for some food. Sex always made her hungry.

As morning approached, Jill complained that its sonar vision was getting fuzzy. It had sent an imp into the radome to investigate, but could find nothing wrong.

"I've checked all the wires and connectors," said Jill. "Since they were jury-rigged when we replaced the radar with the sonar, they were the first things to suspect, but they seem to be fine. I also had the imp measure the sonic pressure from the transducers themselves, and the power seems to be getting out, but the returns are getting more blurred by the hour."

"I'll get suited up and go out for a look," said Gretchen. "Perhaps I can see something the imp missed."

Gretchen waited until the inrush of water into the lock subsided, then swam out the door to the front of the airplane. Jill had turned off the propellers and the craft was drifting slowly forward. The outside branch was waiting for her, and together they unlatched the radome and opened it up. As her suit imp relayed Jill's voice, the outside branch pointed to various sections of the bank of sonar transducers and explained what the computer had checked previously. Gretchen could see nothing obviously wrong, but had the computer take the branch through the entire checkout again while she watched.

As the branch was going through its programmed routine, the water began to get cloudy as if a glass of milk had been released in the water. Suddenly the entire cavity of the radome was milky white, and Gretchen could hardly see the branch through the murkiness.

`Hi! What is this thing?`

Gretchen felt the high-pitched tones of White Whistler through her suit as Jill provided the translation through her suit imp. She felt her hand being raised as the curious alien pushed a portion of its body under her glove to feel the equipment hidden beneath. Gretchen waited patiently until the alien had finished feeling and tasting everything inside the dome.

`Bad!` came an explosive chirp.

"I think it just tasted some of the epoxy glue that we used to attach the sonar array," Jill's voice interjected. "It would still have a strong residual component of hardener."

`Teach me,` came another whistle.

Gretchen smiled at the eagerness of the alien to learn something new, while she in turn was awed by someone who had a greater mental capacity than a dozen humans. She started in to explain how the sonar system worked. It turned out to be fairly easy, since she could

have Jill operate it while she pointed, and White Whistle, having its own sonar system, could easily comprehend the purpose of the system. Some of the components were bewildering to it, however, especially the concept of a "wire" to carry "electricity." White Whistle wanted to "feel" the electricity, but Jill and Gretchen didn't want to risk applying a voltage of any magnitude to such a highly sensitive creature, despite its immense size.

White Whistler quickly understood most of the operation and purpose of the sonar system, then asked, `Why bubbles? I see fuzzy, machine must see fuzzy.`

"Yes!" said Gretchen in surprise. "The sonar is seeing fuzzy images. What bubbles are you talking about?"

`These.` White Whistle chirped as a long snakelike tentacle brushed the inside of the radome and scraped a swarm of tiny bubbles off the inside surface of the dome, where they rose upwards, leaving a clear path of black plastic in the dark grey dome.

`See better,` said the alien through the imp. The tentacle whipped around the inside of the dome clearing away the tiny bubbles that had been scattering the sonar waves as they entered and left the radome. `Now see lots better.`

"That did it," said Jill. "The sonar image is perfectly clear now. There must be a slow chemical reaction between the paint and the ammonia-water of the ocean that creates microscopic bubbles on the inside of the dome. I will have the outside branch wipe them off periodically."

"Thank you," said Gretchen to the alien.

`What means thank you?` asked the alien.

Gretchen sighed, her breath whistling from between her lips, and started to explain the human practice of polite conversation to an alien whose social structure was based on directness. Jill, trying to translate between the two, included the sigh in the conversation without translation.

`Stop!` interrupted the voice from the white alien. `Your pet talk?` A white cloud enveloped Gretchen's visor, while another portion touched the sonar array that was the computer's vocal cords.

"An ideal time to make an important point," Jill whispered through Gretchen's imp. "Repeat the following after me. It is a salutation plus the name of the individual that is surrounding your helmet." Jill whistled a short, but complex tune. It had a few triple-tongues in it, but it was easy for Gretchen, who had been a trombone player in her high school band.

`Your pet say hello!` The white cloud lifted one white tendril from the helmet and another from the sonar array, which had stayed silent while Gretchen had whistled. The two tendrils were absorbed into the interior of the alien, as if checking them out, then another arm of white jelly reached out from the alien to retouch Gretchen's visor. There was a simple tone, a complex whistle, another simple tone, and a different complex whistle.

"Say TtWwOo," whispered the imp into Gretchen's ear.

Gretchen whistled a respectable imitation of the alien number.

Her whistle was repeated by the alien

twice with the same complex whistles in between.

"Now this will show you are smarter than Loud Red's pets," said Jill. "Provided you can get your lips around this one. If not, you can fake it and I'll have the imp make the sound."

Gretchen's pucker and pitch was up to the challenge, and a reasonable facsimile of the number "FfFfOoOoUuUuRrRr" vibrated out through the helmet into the sensitive body of the white alien.

`Smart pet!`

Jill dropped her bombshell.

"This element not pet. Other similar elements not pet. I am pet."

There was a long pause as the white alien thought through the statement. A large portion started to rock up and sink, but then redissolved. The alien formed a lens with part of its body and moved it up close to Gretchen's visor to look in. Gretchen pulled an arm back in from the sleeve in her suit and put her hand up next to her face. Her fingers raised as she went through the addition tables up to five, her fingers adding counterpoint to the whistles coming from her lips. Fortunately she was a quick study in music.

`Stiff:Movers intelligent. Not pets. But not talk correct.`

"Stiff:Movers are humans. Not pets. Not made to talk. They think. I talk."

"I hope I got you out of that with minimum disruption to your superiority," said Jill.

"If we really are superior," said Gretchen.

`What is human buzzing?`

"Human talk to me with buzz. I talk to you with whistle."

Gretchen's imp whispered in her ear. "Do something while talking about it, so I can translate as you talk."

Gretchen reached for her belt and pulled off her Mech-All. She set the handle for a large-bladed screw-driver and the blob at the end of the tool reconfigured.

"This is a tool." She ducked out of the radome to the outside.

"I leave." She reached out and pulled the radome shut.

"I put front of airplane back." Jill translated airplane as pet.

"I fix front of airplane." Gretchen fastened the screw holddowns with the screw-driver tool, deactivated the mechanism into a soft blob, and put it back on her tool belt. The white alien, ever curious, tried to make a small hard sliver and undo the fasteners. Gretchen decided that this was time to assert her authority.

"NO!" she shouted and struck the white appendage with her gloved hand. There was some resistance, but her hand cut through the alien's appendage, leaving a liver-sized portion floating by itself in the ocean. There were strange whimpering noises from the blob that were immediately quelled when the main body of the alien quickly made contact with the severed piece of flesh.

"Oh! I'm sorry," said Gretchen.

The alien re-formed its clear lens and moved it in front of Gretchen's helmet, while a substantial portion of its body lifted up to form a retina behind the lens so it could look at the strange "human" inside the hard metal suit.

`What means sorry?` asked Clear` White`Whistle, ever curious.

Gretchen sighed again.

"It's too bad that we always have to talk through you," said Gretchen to Jill. "With a lot of practice maybe I could whistle the numbers, but I certainly couldn't carry on a decent conversation, even if I could learn the language in a hurry. What we need is a magic translation machine." She paused, then added, "Of course, that's what you are. Too bad it takes up so much of your brainpower to do it."

"Actually, since they are very logical thinkers and we used boolean logic to develop our communication, we ended up speaking in a very formalized manner that is quite different from the way that they talk between themselves," Jill replied. "Most of the translation is handled automatically by a translation table and some simple rules for syntax. I only have to use my more general translation programs when new words or situations arise. The translation table and the syntax rules are too complicated to be programmed into your imps, but they could easily be stored in the mini-processor in your suit chest-pack."

"The suit imp could stay outside as the transmitter and receiver," said Gretchen excitedly. "How about programming my suit now and letting me try it?"

There was a significant increase in the brightness of the laser light passing between the transponder on the top of Gretchen's helmet and a similar one blinking from the left eye of the *Magic Dragonfly*. Gretchen heard the rustle of her suit imp making its way through the valves in the life support back pack to the outside. Soon the metallic green body of the suit imp with its red, yellow, and blue lights was perched on the shoulder of her suit.

Gretchen watched the illuminated message board display in the neck of her visor.

"TRANSLATION PROGRAM LOADED."

"Try it," said her personal imp. "But keep your sentences simple. The translator will ask you to rephrase a sentence if it gets too complicated for the syntax program to handle."

"Hello, White Whistler. My name is Gretchen."

Gretchen could hear the whistles from the waving cilia of her suit imp at the same time she heard a more complex whistle coming from Jill's sonar as Jill explained what had been done. The white cloud swirled up and paused in front of Gretchen's helmet.

`Hello, Gretchen. My name is White Whistler. I touch your Sound:Maker?` A long white pseudopod extended to within a few centimeters of the suit imp.

"Yes," said Gretchen, sure that the wiry limbs of the imp were more than a match for the soft jelly-like flesh of the alien.

The imp was engulfed in a white ball, which withdrew again after a few seconds of feeling.

`Interesting. Each sub-set of Sound: Maker is like larger sub-set. The smallest sub-sets are very tiny. Sound:Maker made like statement in recursive logic.`

"Do all the flouwen like logic?` Gretchen asked, intrigued by the gigantic cloud with the Einstein brain.

`Yes!!!` piped White Whistler. `Tight premises, narrow conditions . .surprise

conclusions! Fun!!` The milky white cloud swirled as it spoke, forming a tight knot that almost condensed into a quartzine rock, then unfurled again to curl around Gretchen's body as close as it could, so as to feel what she was doing.

The presence of the alien was not disturbing physically, for Gretchen had tested herself surreptitiously some time ago by closing her eyes and trying to tell whether it was clear water or curious alien that enveloped her. Without sight, she had as little luck distinguishing aliens from water as she had at college parties back on Earth telling Heineken beer from Budweiser. Still, having an intelligent creature looking over your shoulder, around your waist, and between your legs at the same time did affect her performance. To distract the nosy body she asked a question.

"What kind of problems do you solve?" she asked. "Pure logic or complicated mathematical ones?"

`What?` was the only reply from the imp in Gretchen's ear. The communications link that Jill so expertly supplied had broken down. Gretchen rephrased her question.

"We have many kinds of problems," said Gretchen.

`Fun?` said the alien.

"Yes," said Gretchen. "Some use real things, some use things that are not, but could be. Some use real numbers, some use numbers that are not, but could be."

`Yes. When number squared is one—that number is number one. When some other number squared is negative one—that number is not real number, but could be.`

Gretchen was slightly surprised by the rapid response, especially by the clarity of its simple description. It was obvious that the minor mysteries of imaginary numbers were well known to these amorphous geniuses. She decided to test it with another problem. She would have to think it out carefully ahead of time and state it clearly if she were to be understood.

"Suppose you have a growing thing," started Gretchen. "The growing thing gets bigger. The amount it gets bigger depends on how big it is " She paused to let the idea of an exponentially growing organism sink in, then was rudely interrupted by Jill.

"They already know about exponential growth," said Jill. "I taught them already that the numerical value for pi = 3.14159. , but that was only because they were still hesitant to impose their language structure on me. They taught me the exponential growth factor e = 2.71828. in our language before I could figure out a way to define it in their language. Just say 'e,' and the imp will translate it for them."

Gretchen paused a second to let Jill's revelation seep in, then a little more humbly she proceeded.

"e multiplied by itself one time is e," she said.

`Correct.`

"e multiplied by itself zero times is one," she said.

`Yes,` the white cloud whistled quietly.

"e multiplied by itself pi times is. she paused for a second to listen to Jill through her imp, "23.1407 plus a slight bit more," she said. She took a deep breath, and then started her next ques-

tion, only to have it interrupted by the excited squeal of White Whistler.

and e multiplied by itself pi times square root of minus one is minus one,` said the white cloud with awe. `Isn't that fun! Exciting!! We wish we could find another one.`

Her wind taken out of her sails, Gretchen gave up. "We wish we could find another one too."

There was a loudness and a rippling crackle, and two large blobs appeared in their midst. One poked through the milky cloud that was White Whistler, and the other snaked its way under Gretchen's left armpit. One blob was red, the other was purple, and both quivered with eagerness and questions.

Another one!! the red zucchini squash vibrated loudly.

+Tell!+ rasped the wrinkled purple blob. +Tell about other!+

"Excuse the buzzing one with the strong lavender color," said Jill. "It is an old one that just redissolved from a thinking rock. It has not quite picked up all the human language nuances from the others. I call it Deep Purple."

Another ONE!?!

`No. You heard wrong, Roaring* Hot*Vermillion, not another one. NO other one.

zzzzzzzzzzzzzzzttt!

There was shocked silence.

"Well, there are some other interesting problems," said Gretchen. "Some in logic theory, some in number theory, and some in geometry. There is one famous problem that is part geometry and part number theory."

The purple lobe expanded and with slow, careful enunciation asked, + Logic—OK, Numbers—OK, Geometry??+

Gretchen was puzzled when she heard this. In her engineer's world, geometry was inextricably mixed with numbers. Yet these beings did not manipulate the external world; they just existed in it. Could it be that they had no idea of the relationship of the length of a line to the progression of numbers, and the relationship of the area of a geometrical square to the mathematical square of a number? She tried an experiment. Pulling a diamond scribe from her tool kit, she started to scratch a diagram in the duralloy wing-plate above her. Her motions were interrupted by a squirming feeling at her beltline as three inquisitive pseudopods imitated her entry into her tool pouch.

+Lotsa hard things,+ said the Deep Purple.

Wheeoo! SHARP!! said Loud Red, as it tested a hard acrylic handle on the point of the scribe that Gretchen was trying to use.

`Too many things, White Whistler admonished.

Gretchen got annoyed. She reached down and slapped the offending tendrils away from her tool pouch, glared around angrily, then carefully sealed each centimeter of the rip-seal seam. She again reached up to the under part of the wing with her diamond scribe held firmly in her hand. For once she had the full attention of the frivolous multitude of aliens.

Carefully, she scratched a right-angled triangle on the skin of *Dragonfly*'s wing. Then, just as carefully, she measured off the length of one of the shorter sides by laying the scribe

along the side and pinching it carefully between her gloved fingers. She turned it at right angles and marked a point. In a few seconds she had constructed a square that used one of the triangle sides as one of its sides. She was halfway through constructing the square for the other side when the silent chorus broke into cacophony.

+Yes! Three and Four is Five!+

HA! PYTH THEOREM!! roared Loud Red.

"They mean the ancient Greek theorem ascribed to Pythagoras," said Jill. "I told them the human name for the theorem."

"Thanks," said Gretchen, trying to separate the alien responses from Jill's.

`We understand your diagram,` said White Whistler, `even if you can not draw it because of others.`

There was a pause as the purple and red protuberances retracted under the seeming glare of the white cloud.

`Tell of problem.`

Gretchen felt flustered. She was not a mathematician, and it was obvious that these creature knew the fact that a right triangle had two short sides and one long side, and that the squares of the lengths of the two shorter sides equalled the square of the length of the longest side. She felt stupid as she tried to get across in simple language the idea of one of the most famous unsolved problems in human mathematics, Fermat's Conjecture.

She pointed her scribe at a triangle enclosed in squares inscribed about its perimeter.

"Three times three, plus four times four, equals five times five," she said.

+OK!!+ said Deep Purple enthusiastically.

Yes!?! said Loud Red, with an inquisitive quiver in its tendril.

`The square of the hypotenuse is equal to the square of the other two sides,` said White Whistler, and Gretchen was shocked to realize that the voice vibrating her body with an accent that was almost pure Jill had come directly through the water from the alien.

Gretchen felt really inferior. White Whistler had learned human speech and Gretchen didn't even know how to whistle (or roar) their names.

"One of the unsolved problems in human mathematics was conjectured by the human Fermat. There are many solutions to x multiplied two times. But there is no solution to the problem of x multiplied three times, plus y multiplied three times, equals z multiplied three times even if three is any number."

+That not problem!+ Deep Purple. graveled.

That's a DUMB problem!! the red cloud exploded. *That problem not said right. I say right way. X squared times Y squared equals Z squared has many solutions. Is there a solution for U cubed plus V cubed plus W cubed equal Z cubed? That make more sense. You have two things X and Y. You multiply two times. You add two times. You get same as Z multiplied two times. Two things three times is DUMB!! If you multiply three times, then you should add three times!*

"But *is* there an answer?" persisted Gretchen.

+Answer?+ echoed Deep Purple. There was a long pause. Then the other

colored portions of the water retracted as Deep Purple condensed into a purple boulder some meters beneath Gretchen's feet. She had not realized how massive the old purple one had been, for its cloud extended tideward as far as she could see. Like a motion picture of a vaporizing block of dry ice run backwards, the gigantic purple cloud condensed into a slippery purple rock—a thinking rock—thinking about a problem put forth by a brilliant human mind long ago and far away.

I'm going surfing! said Loud Red. It swam up to the top of the wing and perched there, its weight causing a slight list to the plane. As the next roller broke over the plane, Loud Red used the inertia of the wing to launch itself onto the forward surface of the wave.

Wheeee!!! came the cry of excitement through the water, fading into the distance as the wave carried the red alien off.

"I wish I could surf," said Gretchen wistfully.

`You are the wrong shape to surf,` said White Whistler.

"I could surf if I had a surfboard," said Gretchen, her thoughts going back over six lightyears and forty time-years. Fortunately Jill was back in the translation loop and it took an extended discussion between the computer and the alien before it understood what a surfboard was.

`I be your surfboard!` said White Whistler. It swooped under Gretchen and picked her up on its massive body, a cavity appearing in the top of the alien's body to cradle her.

"What's going on?" came Richard's concerned voice over the imp link.

"I'm going to get a ride!" shouted a delighted Gretchen. The white alien humped itself up on the plane wing.

"Jill! Make her stop! That could be dangerous!" Gretchen could see Richard through the left cockpit window. He was yelling and waving his hands at her, trying to make her get down off the alien.

Gretchen grinned and waved back at him.

"Kawabunga!" she cried as a roller lifted the wing and White Whistler launched its multi-ton body onto the wave.

The wave was traveling toward the center of an underwater volcanic vent field that had produced a long sloping ash and lava shield. As they moved toward the central region, the ocean became shallower and the wave steeper. It was a long ride, and after they had gone a kilometer they were out of range of Jill's sonar and laser beacon. Gretchen had to depend upon her chest-pack translator for communication. White Whistler noticed the lack and switched to using simplified speech patterns. Although both enjoyed the ride, White Whistler's curiosity led to questions.

`Humans are strange elements. Not see before. I swim entire world many times. Never see humans. Where humans exist before now?`

"We came from lights in sky." Suddenly Gretchen realized that the aliens had no eyes, so perhaps they didn't know about the stars, although they probably knew about Barnard.

`I know many lights in sky. There is Sky:Rock, you name Roche. There is Hot, you name Barnard. There is Warm and little elements. There are many

other lights. All tiny except one new one. They are my research.`

An eyeless astronomer, mused Gretchen. *It even has to make its telescope lenses from its own flesh.* She started to think how to tell the alien that the stars were suns like Barnard and that she came from a planet around one of those stars.

"The other lights we call stars. They are suns like Barnard, but far away."

`Not all are like Barnard. Some have color of Barnard. Most have different color. Some yellow like spots on Barnard. Some white like light from storms. Some blue. Different kinds of suns.`

You may not have eyes, said Gretchen to herself. *But you have a marvelous color sense if you've been able to deduce that the stars are suns just from their spectrum.*

`One star was not like others. Star was yellow for a long time. Then star get brighter and color is green. Then after 3,000 days star became yellow again.

"That is star of humans," said Gretchen, much relieved that the problem of pointing out which of the many stars was her home sun had been solved by their method of arrival.

`Human star far away. Your plane swim long time.`

"Humans not use plane. Humans use big .circle. You see big circle in sky?"

`Yes. Big circle not logical.`

"Not logical? I do not understand."

`Lights in sky are my research. I know stars are suns. I know Sky:Rock is like our world, but with no water. I know Warm is like a big world with more clouds. I know little ones of Warm are almost equal to our world. I can predict motions of all lights in sky except one. That one is big circle. Big circle is not like anything. It is circle, not sphere. Its motion has no logic. I think long to find logic of big circle motion. I can find no logic in motion.`

"Big circle is not heavy like other lights," said Gretchen. "Big circle swims like pets of Green Buzzer. Big circle swims in light from Barnard. Subtract big circle from set of lights in sky. They do not swim. They move by logic of gravity."

`Word is missing. Logic of

"Each sphere in sky is pulled by other spheres in sky. A big sphere pulls more than a small sphere. If two spheres are near, the pull is strong. If two spheres are far, the pull is weak. Amount of pull varies as inverse square of distance between the two spheres."

`That was the hypothesis I was using! Then big circle came and its motion did not fit hypothesis. I rejected hypothesis and looked for a new hypothesis.`

The alien stopped its slow swim back to the airplane.

`I must think.`

Gretchen felt the body of the alien contract around her, getting harder and more rubbery as the liquid was squeezed from the jelly-like body. Suddenly she found herself floating in the water as a white rock sank beneath her to the bottom.

"White Whistler!" she cried through her outside imp. "Come take me back to the plane! I can't swim 20 kilometers in my suit, even if I knew which direction to swim!!!"

There was no answer.

TO BE CONTINUED

the reference library

By Tom Easton

Lumière, Cris Williamson, Olivia Records (4400 Market St., Oakland, CA 94608), $8.00.
The Beast, R. Stallman, Timescape, $2.50, ? pp.
The Black Beast, N. Springer, Timescape, ? pp.
Earth Dreams, J. Morris, Putnam, $14.95, 240 pp.
Erasmus Magister, C. Sheffield, Ace, $2.50, 217 pp.
The Sardonyx Net, E. A. Lynn, Berkley, $2.75, 423 pp.
Forbidden Sanctuary, R. Bowker, Ballantine, $2.50, 203 pp.
The Iron Dream, N. Spinrad, Timescape, $2.95, 256 pp.
Unicorns!, J. Dann and G. Dozois, eds., Ace, $2.75, 310 pp.
Universe 12, T. Carr, ed., Doubleday, $10.95, 181 pp.

Maine, especially the depressed boonies where I live, is a long way from the big city. Thank goodness. This last weekend I went south to attend my brother's wedding in Connecticut. It's been a while since I last went down there, so I had mercifully managed to put the scene out of mind—the traffic, the crowds, the air that makes your mouth taste bad and your throat hurt, the noise, the prices. Ye ghods and little fishes!

I drove down on Friday and back on Saturday. I got home tired and butt-sprung and glad to be there, glad that I don't have to work in a city, glad for a writer's independence, and glad to have a lead for this column.

Actually, leads aren't hard to come by. They can even be dispensed with entirely in a column like this one. I do that sometimes, but when one shows up at just the right time, it's hard to resist it. That's partly because timing is so important to a writer, timing of ideas and work and checks. And speaking of timing—I have just put the finishing

touches on the manuscript of *Working for Life: Careers in Biology* for Plexus, the outfit that publishes *Biology Digest*. It's scheduled for publication in the fall of 1982, and it should be available to any of you who want to know about variety, pay, and prospects in the fields of biology by the time you read this. With that and this column out of the way, I can start work on *Writing the Readable (Technical) Report for Business*, a 50,000-word text with a November 1 deadline, according to the contract I signed with Dow Jones-Irwin two weeks ago. Content I can't say a lot about just yet, since all I've written so far is a three-page outline. (Writers take note—DJI let me scratch out the option clause.) Publication should be next spring. And that *is* a pair of shameless plugs.

And so to business. Let's start the reviewing with a bit of SF-exploitation. It's an LP record, complete with text-booklet, words and music by Cris Williamson, a Baez-Collins pop-folk artist. It's **Lumière—A Science Fantasy Fable.** If you read the text first, you won't be impressed. As a short story, it's weak, pretentious, arbitrary. If you listen to the record first, you may be a little more pleased. The story is much more effective told aloud, with music and song. But it's still weak, and it's not for children, despite the album copy.

The story is a dream. It begins when X-Ray Ted, small boy, dreams of his mother hollering at him for not cleaning up his closet. Mama's household robot then picks him up and hurls him into space. He then dreams he wakes to see a strange light in his closet, which he follows to a world where people are stars full of mystic power. He wakes for real in the morning and, wonder of wonders, he cleans up his closet before breakfast.

Yeah, it's a fable. It even has a moral. So it's good for kids, right? But the opening bit is gratuitous. It's not needed, and I can easily see how it could give a kid totally unnecessary nightmares. It didn't affect my almost-five-year-old that way, but then she wasn't very thrilled by it either.

Do you want it? It's got some nice art work, electronified voices, and sound effects, but not much else. Williamson's voice is quite reminiscent of Baez and Collins, especially the latter, and her lyrics don't have a lot of potency either. Give it a miss, unless you just have to have multi-media SF. There isn't that much of the stuff.

Our second item is a curiosity, and probably a screw-up. The Timescape press release *says* it's the galleys for the late Robert Stallman's **The Beast,** Volume 3 of his Book of the Beast, following *The Orphan* and *The Captive*, to be published in September. I've been looking forward to this one, expecting to enjoy it and to enjoy telling you to reach out and buy it. I therefore unsnapped the rubber band and unfolded the wad of 6" x 20" sheets (galleys) eagerly, all set for a pleasant evening's read.

Howsomever, gang—what I had was *not The Beast*. The lines at the top of the first sheet looked like this:

3967—THE-BLACK BEAST—1
9 on 10 x 20 Oon 21
T.R. No. 5

The story that followed was a fantasy set in an isolated, mountain-ringed land where the gods walked among the people and a black monster embodied the king's fate. It was the story of two princes who rebelled against their father's madness and sought a way to end the custom that killed the king after a 20-year reign, a story of the civilizing process, if you will.

It was a good story, too, readable and entertaining. It turns out to be, I'm told by the *Analog* staff, **The Black Beast,** by Nancy Springer.

I did write Timescape's Director of Publicity, Carol Fass, to complain and to ask for the Stallman galleys. That was weeks ago, and I've had no answer yet. I don't really want to delay telling you about **The Beast** for another month or more, though, so I must "review" it by quoting the press release.

Timescape calls it a "haunting work about an alien creature, a shape-shifter, coming to maturity in human form in the American midwest of the 1930s" which "concludes in *The Beast*. Now, for the first time, readers encounter another Beast, this time a female, whose experience parallels Barry's" (the first's). "She is headed for the Southwest, in order to find Barry, whose existence she is mysteriously aware of. She assumes human form in the guise of an old woman, of the tribe with which Barry is becoming involved. As the two aliens discover each other, they also discover they have each matured sufficiently to perform a 'mating' ritual. As a result they transcend the plane of human reality, and provide new and independent lives for their host humans."

I expect the book to be as good as its predecessors, and even to answer many questions raised in those books. I wish I knew for sure. If Timescape ever sends me a copy, I'll read it. If I then have anything to add, I'll put it in a future column. In the meantime, buy the book on the strength of Volumes 1 and 2.

Janet Morris's **Earth Dreams** is #3 in another trilogy, which began with *Dream Dancer* and *Cruiser Dreams*. Here the human worlds, scattered through at least two galaxies, are linked by faster-than-light travel through "sponge-space" and ruled by consuls whose middle names are those of ancient kings—Seleucus, Alexander. Long ago, the humans who loved change and constant learning left Earth for space. The traditionalists, the change-fearers, who preferred the past to the future, mysticism to rationality, stayed at home and became barbarians.

From the barbarians came Shebat, for whom magic worked. Taken from Earth by the mad prince Marada Kerrion, she became a sponge-pilot, at symbiotic one with her sentient ship; was anointed heir-apparent to the Kerrion empire; and married Marada's saner brother, Chaeron. Up to her pretty neck in family intrigue and in-fighting, she winds up on Earth again, to which her husband has been banished to raise the barbarians to civilization despite Marada's interference. Here *Earth Dreams* opens, and continues with intrigue, violence, victory, and a smidgen of sex.

The novel deals with change-lovers who link their brains to computers as a matter of course and live large parts of their lives in a flow of abstract information. Herein may lie the book's greatest problem. We see too little of the characters' fleshly lives to identify with them well. Morris leaps from event to event. Things happen without visible lead-up. More things, and vital things, happen entirely off-stage, and we see them only in their consequences. Motivation is clearly there, but not in a form the reader can readily grasp. This may in fact be a fairly reasonable embodiment of the life-style Morris has imagined in great and laudable detail, but I find that it interferes with the story. And I find little help in Morris's relatively turgid style.

The publisher calls the trilogy "the greatest science fiction adventure story since *Dune*." Maybe so. It's received

a good amount of praise and is apparently selling well. I suspect this is due far more to the intricacy of imagination and character (though the characters may be the weakest part of the story; I find it difficult to believe their posturings) than to the story itself. That seems too hard to unravel, too shy of immediacy. The trilogy would have been much improved, to my mind, if Morris had boiled it down into a single longish volume.

Charles Sheffield has been busy lately. This makes the third column in a row with something by him! This time it's **Erasmus Magister,** a set of three novelettes dealing with Erasmus Darwin, grandfather of Charles and an evolutionist in his own right. He was also a famed physician and botanist who wrote scholarly works in verse, and a human being who loved good food and good company. In some ways, Anderson's Nicholas van Rijn might have been modeled on him.

Erasmus Magister is not simply historical fiction, for its events never happened. At least, there is no record that Erasmus ever really sought — or found — the Loch Ness Monster or underground remnants of the dawn of Man. He might have explained away a family curse in terms of epilepsy and visual flicker. These are the stuffs of Sheffield's fiction, and with Sheffield's penchant for rational explanation and justification, they become even science fiction, not the "historical fantasy" touted on the cover.

Sheffield has done a delightful job of bringing the past to life and of livening the spirit of one of our honored predecessors. I enjoyed the book tremendously. I hope you will too.

Elizabeth Lynn's reputation has been growing with every book, and **The Sardonyx Net** isn't hurting her a bit. Dana Ikoro is smuggling a shipment of the drug dorazine to Chabad, where it is used to keep docile those who serve out their prison sentences as slaves. Hijacked, he goes to Chabad anyway, only to be convicted of attempted drug-running and enslaved. From his viewpoint, then, we see the system's effects on slave and slaver, the panic as fanatic anti-drug cops invade the world with ruin, the pain of incestuous love turned aside into sadism, and the pride of a man who would honor commitment above all but cannot. That man is Dana, who comes to love his mistress and struggles to save her from chaos even as her brother, the sadist, who has once completely subdued Dana's sense of self, brings him to his knees with but a glance. He transcends himself when he rescues that brother from death as one of the fanatics blows up the Sardonyx Net, the starship Chabad uses to transport prisoners, or slaves.

The book's theme is the meaning of freedom, asking whether anyone can truly feel free when in chains, however gentle, however short-term. Lynn's answer is not surprising, but it is beautifully demonstrated, especially in its equation of slavery and femininity (and childhood, to a lesser extent) and its "proof" that pet names can be demeaning. Lynn is beautifully deft, not least in such small touches as Cat Graeme, a mercenary cop from Dickson's World. And she has a rare hand with female characters—as we might expect from a female author, but too rarely see, her women are strong and real, full of juice, the men but relative shadows; it usually seems the other way around. Oddly, when physical action is required, she often lets her men take the brunt of it. Certainly, it is men who

suffer from the male sadist, and Dana who, beat upon and kidnapped, saves the day. If you read the book and choose to argue with me, I'll grant you immediately that Lynn's women are anything but passive, but they are not the centers of violence. And this may be quite reasonable. I've met few women who really want to disclaim that "gentler sex" label. Who *wants* to be a brute, after all? But women *are* capable of being the center of violent action, and they can in fact be as vicious as any man. It's a dum shame that when a writer tries to portray a woman in that way, he or she can't escape the smell of black leather.

Enough. Hail the lady. (Why isn't her name Mary? Then I could say a "Hail Mary"!) Buy her book. Shower her with royalty checks, that she may continue to bless us with good reading.

Less ambitious and less successful, to my mind, is Richard Bowker's tale of flying pyramids driven by the power of love. That's right, folks. It's **Forbidden Sanctuary.** Aliens discover Earth, materializing in Massachusetts, of all places, in just such a vessel, though the secret of its power takes a while to come out of the closet. They are promptly fenced in, literally and figuratively. Fortunately, they prefer not to explore on their own, but to meet suitable human emissaries aboard their ship. Among these emissaries are the few linguists who become translators. There are also baffled scientists, politicians, and even a theologian. And it is this last who sparks the story's plot, for his translator discovers that the aliens harbor a persecuted cult akin to early Christianity, even unto the resurrection. She, being a good Catholic, goes to her priest, who bumps the matter through less-than-formal channels all the way to the Pope. Then an alien cultist escapes and begs for sanctuary from the Church.

The issue is plain: Should the Church give sanctuary? Should it insist that it will return the alien to its persecutors only if the persecution stops? Should it just return the being? The argument is fierce, and the ensuing political machinations are ferocious, but in the end it is love—of God—that wins the day.

Yeesh! Yah. Maybeso. I suppose, if, and if, and if again, it might work out just that way. And Yah, religion is quite potent enough a force to play a role — even *the* major role — in a first contact. But Bowker is too sanguine by half. I don't believe for a second that the Church would hesitate to hand an alien over; it would be too paranoid not to. Nor do I believe the alien would dare seek sanctuary among us; he too would be too paranoid. Nor do I believe in explorers who don't explore (they make their trips solely from religious motives). Nor do I believe the alien drive, however beautiful, symbolic, and downright Freudian it may be.

Still, the story does move right along, and the premise is intriguing. So will somebody please tell me to stop my atheistic quibbling? Did I enjoy it at all? Yes, and more than a little, even. Bowker's a competent writer. He's bound to get better, too, and I do look forward to his next.

Will you enjoy it? I dunno. Depends on how cynical you are about religion, doesn't it?

Norman Spinrad's **The Iron Dream** has now been reissued. Remember that one? Or all the fuss it provoked? No? It's a coy little joke, folks. Behind Spinrad's title page lurks a second, billing the contents as *Lord of the Swastika,* by one Adolf Hitler. It seems that Herr

Hitler left Germany in 1919, after a brief dalliance with fascist politics, and became a SF fan, illustrator, and fourth-rate writer. This is his master work.

The real Hitler would have loved it. It's the ultimate race-supremacist dream of blood and gore, here that of subhuman mutants ruled by the Dominators of Zind (get it?). The hero, the pure human genotype Feric Jaggar, through the power of frenzied oratory and clear vision, sparks and leads a cleansing of the Earth, and then, finally, in an ultimate *reductio ad absurdum*, of the universe.

Oh, for a time machine! Clip the insulting afterword off this book, go back, and give a copy to the mad housepainter. Better yet, put a few hacks to work grinding out similar stuff—invent a subgenre!—and give it all to the man. With luck, he'd be kept so busy satisfying his fantasies vicariously, or so drained of pathological need, that history might rerun in a far kinder vein.

You get the idea. For us, the novel is virtually unbearable. It's so puerile, so gratuitously bloody, so .Yes, that *is* the whole point. And yes, that Spinrad could pull it off is a credit to him.

And finally, I have two anthologies for you this month. The first, edited by Jack Dann and Gardner Dozois, is **Unicorns!** It offers you sixteen stories by Davidson, Sturgeon, de Camp, Niven, Ellison, Swann, LeGuin, Wolfe, Zelazny, *et alia*. None are bad, some are good, and a few may even be great. I commend to you Zelazny's "Unicorn Variation," in which a unicorn, a sasquatch, and a man play (fairy?) chess for the world. I also recommend Sturgeon's "The Silken Swift," for which virginity becomes a state of mind, as it should. I can't really praise the book as a whole, though. Whether you can stand such a dose of unicorns depends on how mad you are for the beasts.

Terry Carr's **Universe 12** doesn't seem quite as marvelous as #11. Fewer stories seem prizeworthy, though the anthology still easily surpasses the average magazine issue for overall quality. The two best stories are Howard Waldrop's "God's Hooks," in which Izaak Walton goes fishing in John Bunyan's Slough of Despond for Leviathan and finds a Truth only a trout fisherman can know; and Leigh Kennedy's "Helen, Whose Face Launched Twenty-Eight Conestoga Hovercraft," in which art, friendship, and love confront politics in an antique space habitat.

As for the rest of the stories, "Thieving Bear Planet" is a typical Lafferty. Mary Pangborn's "The Sorcerer's Apprentice," in which a wizard and his helper yank an anthropologist out of time, is neat and wry but fails to climb far above the trivial. James Patrick Kelly's "In Memory Of," the last memoir of the last member of the family that gave the world video-taped wills, is bitter, but not nourishing. Bruce McAllister's "When the Fathers Go," deals with interspecies miscegenation but is screwy in the head, though deliberately so, I grant. Nancy Kress's "Talp Hunt" is a confusing account of how an operation that opens the mind to ancestral memory might affect others. Kim Robinson's "Exploring Fossil Canyon" is a so-so tale of love among Martian tourists. George Turner's "A Pursuit of Miracles," exploring how a lab-engineered "special edition" human, treated as subhuman, finds love, is frustratingly flat.

But don't let me put you off. He does offer a good bunch of stories, and two are superlative. ■

brass tacks

Dear Stanley:
I think I know where Frank Cox got the idea that 90% of the population is "incapable of truly intelligent (versus instinctive) behavior." He may or may not be a liberal, but apparently he has been misled by liberal propaganda. Liberals for the most part are closet aristocrats (it is no coincidence that the leading liberal politicians in this country have been heirs of east coast old money), who have a basic distrust of people in general. This is why they characteristically favor big government to control everyone strictly. Their penchant for throwing money at social problems is an extension of the medieval patronage system, wherein aristocrats sought to assuage their guilty elitist consciences by doing good works for the peasants. It is convenient for liberals to denounce the 90% of the population that disagrees with liberals. It is worth noting that if what liberals say were true, then democracy could not work. Liberals' slandering of the majority is really an attack against the idea of democracy. Let's get our eyes back on reality. The next time you walk down a city street, look at all the people around you—and see if you can maintain that 90% of them are uncivilized, unthinking, incapable of intelligent (versus instinctive) behavior. In actual fact, very few people are uncharitable, dishonest, or disrespectful toward others. And while this may come as a surprise to solipsists, other people really do think, too. They are no more blindly led by their instincts than many elitists are. The vast majority of people is law-abiding, except when the law is unreasonable. Those who are the troublemakers in society—the ones who make multitudinous laws necessary—are in a decided minority, certainly less than 10% of the total population. Thus, the truth is exactly the opposite of the way

liberals represent it. It is not the 90%, but the 10%, who make rational government difficult. In your space-age utopia, it is the worthy 90% who need to be isolated from the barbarous 10%. Granted, not all of that 90% may believe the same as you and I about the importance of expanding free enterprise into space. (Note that liberals are most often the chief impediment here.) But being wrong is not the same thing as being unreasonable. Being ignorant is not the same thing as being unintelligent. And obviously, being liberal is not the same thing as being wise.

RON LAMBERT

Troy MI

Dear Stan,

Carol Rosin and I are in the process of preparing a book called *Space Careers*, to be published in 1983 by William Morrow. Since *Analog* readers are in my opinion one of the most knowledgeable groups around on the potential of space and on the practical problems of space development, we would be delighted to hear from them. Are there any particular topics that you would like to see covered, or questions that you would like to see answered? We have our own list, but we don't want to miss anything that could be important. Correspondence should be sent to: Charles Sheffield, Earth Satellite Corporation, 7222 47th Street, Chevy Chase, MD 20815; or Carol Rosin, 5610 Ten Oaks Road, Clarksville, MD 21029. Unless we become absolutely flooded with letters, we will try to give anyone who writes to us a personal reply.

CHARLES SHEFFIELD

Dear Mr. Schmidt: How much do I like *Analog*? Well, my only complaint is that I get each issue read from cover to cover so quickly, and then I have to wait nearly a month for the next one. It's a long wait.

I must take exception, however, to James Gunn's paranoid sermon in your August issue ("The Anti-Nuclear Conspiracy"). I firmly believe that anti-nuclear activists often engage in ignorant, irrational hysteria, much of which probably has its roots in the anti-science, anti-technology mood of the back-to-the-land movement of the hippie '60s. It is a viewpoint I wholeheartedly disavow. But if a large segment of the American public distrusts the nuclear industry, there's good reason for it. The nuclear industry had lied to and deceived the public time and again, at Three Mile Island and elsewhere. There are numerous examples on record. Having lived in the shadow of the unfinished Diablo Canyon reactors for four years, I've seen it happen here. And in 1965 I may have unwittingly engaged in falsification of electrical cable and conduit test data while working on a reactor project in a certain western state. Gunn's "imaginary conversations" are a cheap shot. He gets to infer there are people out there saying these things without having to prove it. I can play that game too. How about some "imaginary conversations" from the board room of a certain western power generating company, all based on *actual events* surrounding the construction of Diablo Canyon:

"Bad news, boss. That earthquake fault offshore we're not supposed to know about is getting a lot of press."

"Well, keep stonewalling; keep downplaying its potential. We can't let that thing stop us."

* * *

"More bad news, boss. Seems we just found out the cooling units in the reactor buildings were installed back-

wards. Now their quake supports don't meet the design specs."

"How the hell did that happen?"

"Well, ah, we had the blueprints backwards."

* * *

"The worst is yet to come, boss. That independent review of our safety procedures just came in. It doesn't make us look too good."

"Then edit the damn thing! We can't let the NRC or the public see it like it is!"

BILL SCOTT

San Luis Obispo CA

I think you missed the point. The story did not purport to prove that the conspiracy exists, but to point out that most of us are in a disturbingly poor position to know *how much the "facts" are shaped by "imaginary conversations" like the ones in the story—or the ones in your letter.*

Dear Dr. Schmidt:

Greg Bear's story, "Schrödinger's Plague," in the March 29, 1982 issue has prompted me to write another letter after these many years, since I am planning to include a discussion of the Schrödinger's cat in my current book (working title: *A Model of the Human Mind.)* I am a long-term reader of *Analog/Astounding*, since the late '30s. I have had many enjoyable exchanges with John Campbell.

The answer to the question: "Is the cat alive, dead, or both?" is "Alive, mostly." The proponent of the intended paradox neglected to take the Heisenberg principle into account in its full ramifications.

To review the problem, Schrödinger's cat is trapped in a room with a geiger counter monitoring some radioactive material. The counter is arranged to trip a trigger which is supposed to drop a hammer upon a flask filled with poisonous gas. There is a 50% (0.5 probability) chance that in one hour one of the nuclei of the radioactive material will decay. According to Schrödinger's wave function, at the end of the hour the system will have a form in which the living cat and the deat cat are "mixed" *in equal proportions*.

In the scenario described above, the operative word is "equal," and therefore the conclusion is invalid.

One must also take into account the system *and the participant*. The participant in this case is the cat, whether it likes it or not.

Now any engineer worth his salt in designing systems will tell you that "there ain't no such thing as a perfect machine." This is especially true when the system output is dependent upon a chain of events/components operating in sequence. If any part of the chain is inoperative, the system fails.

In dealing with systems reliability we are in effect using an inverse corollary to Murphy's law; nowhere are we optimistic enough to assign a 100% reliability factor to key components. Even in integrated circuits, although orders of magnitude more reliable than vacuum tube circuits, molecular migration takes place, and they are still plagued on occasion by spontaneous emission of particles within the IC package which can render a circuit temporarily or permanently inoperative. This is why we still must design redundancy into the hardware and software of computer systems to make them useful on a practical level.

In examining the cat system, we must recognize that the geiger counter is not perfect. Therefore, its reaction to a particle is not at certainty (R = 1.0), but only a high probability. The trigger mechanism may or may not work. The hammer might miss the flask or hang

up. Since the flask, like the kitchen match, cannot be break-tested before use, it may not break from the hammer blow. Finally, the cat, which is a participant, can affect the system, perhaps on a mundane level by knocking the flask out of the way or hanging up the system in some way while it is moving about the room.

Just for fun, let's do some arithmetic. You may quibble with the probability factors I've assigned, but it serves to prove my point. If we include temporary errors (and that's all it takes!) in a subsystem, then a mean time between failures of 1,000 hours is pretty darned reliable. I can't get that with my professional oscilloscopes and digital voltmeters. A MTBF of 1,000 hours means that there is a .999 probability of working one hour without temporary or permanent errors.

Component	*Probability of no errors*
Geiger counter	.999
Trigger mechanism	.999
Hammer operation	.999
Flask breakable	.998
Cat influence	.8

The probability that the gas will escape and kill the cat is the product of the probabilities, including the given probability of 0.5 for the particle emission. $S = 0.5 \times .999 \times .999 \times .999 \times .998 \times .8 = 0.398$

This means that the probability that the cat is still alive at the end of one hour is $1 - .398 = .602$. That is, there is a 60.2% chance that it is alive, because of the system and participant included in the measurements. Only if a means were devised where the particle itself killed the cat, without adding instrumentation, would the probability approach 50/50. Even then, it would be skewed one way or the other because the cat is still a participant.

I wish to extend a long-delayed "thanks" to *Analog* for influencing my career. I have been in the computer field for over thirty-five years, and have been privileged to make some basic contributions to the technology. I designed and built my first computer (would you believe it was a games-playing machine?) while a freshman at the University of Kansas in 1946. My interest in computers was stimulated in part by *Astounding* articles on computers by, as I remember, E. L. Locke.

DENNIS WILLARD
P.E. Consulting Engineer,
Control Systems, and Management
Consultant
Santa Rosa CA

Dear Mr. Schmidt,

In the July *Biolog* of Janet Aulisio, Jay Kay Klein states that her first professional assignment was for the May 1978 *Analog*. It occurred to me that I first noticed her work before that, so I dug out the old magazines and, sure enough, found some examples in the June 1977 *Galaxy*. My short search taught me two things: that Ms. Aulisio is an exceptional artist, as her illustrations were often more memorable than the stories, and that finding a long-forgotten illustration was much easier in *Galaxy* than *Analog*, as the illustrators were listed on the contents page. I would like to suggest that *Analog* adopt this practice.

JOHN ROWLAND
Canoga Park CA

A nice idea, but one we won't be able to adopt in the near future. The problem is that our contents page already has about all it can handle.

Dear Editor:

The Dulski and the Zahn (in the July '82 issue) were carefully thought out adventure stories, though containing nothing I'd care to file in long-term

memory. Likewise for "Glossolalia," an amusing commentary on the gobbledygook that passes for English in various business communiques and on the lack of standardization that's endemic to any technology in its beginning stages.

Kube-McDowell's "P.E." was something else again, being an ambitious sketch of the rapid education—or forced indoctrination, if you like—of somebody that wishes to avoid the consequences of his past actions. (Actually, it was too ambitious, trying in short-story format something that required novella-length expansion.) And that one particular aspect of immortality—the creation of a ruling Brahman sect that pays little attention to testimony of short-termers—is something I don't recall seeing discussed before.

(This same type of situation occurs, incidentally, at universities where students want to assume duties ordinarily performed by the Board of Regents. As I heard one university president say, "You students won't be around in ten years to experience the consequences of your decisions as board members—but *we* will.")

The conflicts posed by such situations—decisions for immediate expediency vs. those made "under the aspect of eternity"—can't be resolved, even in the Linear Programming sense of maximizing a function of n variables subject to m constraints—since the long and short-term extrema generally won't coincide, and which to take is a moral decision that a computer won't resolve. Of course, it's not the author's job to "solve" such problems, only to dramatize them, as McDowell has done, in the most vivid manner possible.

LELAND SAPIRO
Coker College
Hartville SC 29550 ■

COMING TIMES TO COME

● Two years ago, as of this issue, we published a story called "Emergence," by a new writer named David R. Palmer. That story placed first in our yearly AnLab and wound up on the final ballot for the Hugo award for best novella of the year—quite a pair of accomplishments for a newcomer's first story! It also produced a *lot* of mail asking for a sequel, and next month we have one. "Emergence," as you likely remember, was the story of Candy Maria Smith-Foster, 11-year-old supergenius who finds herself alone in an underground shelter after a particularly nasty nuclear-biological war which has pretty well done in *Homo sapiens.* But Candy has reason to suspect there are a few others of her kind out there, and at the end of "Emergence" she was setting out to find them. In "Seeking," the search gets well underway, and I think you'll find it well worth waiting for.

Our February issue will also feature the conclusion of Dr. Robert L. Forward's *Rocheworld* (which would make a spectacular movie, if somebody has the imagination and budget to try it) and a variety of stories and articles, very probably including pieces by Frederik Pohl and Ray Brown.

INDEX

Here is the Index to *Analog*'s fifty-third year: 1982, Volume 102. Entries are arranged alphabetically by author, with month and page. (Due to changes in our dating system this year, there were two issues in March, abbreviated Mar1 and Mar29; two in September, Sept and MidSept; and none dated April.) Multiple entries by the same author are listed in chronological order. When the author's name and/or part of the entry's title is omitted, it is the same as that of the previous entry. Collaborations are listed under all authors, with cross-references. Unless otherwise noted, each entry is identified as a novelette (n), short story (ss), or fact article (a).

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(Continued from page 105.)

are part of a law-enforcement group which explores and protects the outer worlds of an empire.

Gamma World (TSR Hobbies) is similar to *Aftermath*, but is set some time beyond the holocaust. Players explore a world where mutational powers, fragmented technology, and ancient skills contend for power.

Space Opera (Fantasy Games Unlimited) emphasizes, as its name implies, the fun aspects of SF rather than technical accuracy. It's pirates on the Spanish Main—except in outer space.

Star Frontier (TSR Hobbies) is the newest entry into the SF rpg field. An unusual feature is that it allows the gamers to play either a human or alien character.

Star Leader (Metagaming Concepts Inc., Box 15346, Austin, TX 78761) is being released in a series format, with the first module, on man-to-man combat, called *Assault*. The next module will be called *Warships*.

Star Patrol (Gamescience Inc., 01956 Pass Road, Gulfport, MS 39501) is a simple design that uses many aliens as part of the game that have appeared in works of science fiction.

Traveller® (Game Designers' Workshop, Box 1646, Bloomington, IL 61701) was the first and is the most popular SF rpg. It's drawn from adventure-oriented science fiction and postulates that mankind has conquered the stars.

Universe (TSR Hobbies) was originally published by another company and then acquired by TSR. It's not directly competitive with TSR's *Star Frontier* since this game's system concentrates on detailed charts and the technical aspects of creating starships, etc. ■

IT'S ANLAB TIME AGAIN! This issue completes 1982 for *Analog;* now it's time for you to let us know how we're doing. The authors are interested, I'm interested, and you should be interested—because your feedback about your likes and dislikes will have a second-order feedback effect on what we offer you in the future. So please vote. Here's how: Look over all your copies of *Analog* dated 1982. From them, pick your *three* favorites in each of the following categories: novella/novelette (a *single* category), short story, science fact article, and cover. Then drop us a line listing your choices in each category, in order of preference. We'll tabulate the votes and let you know how they came out.

We normally ask for your votes on serials as well, but only two appeared complete during 1982.

Please send your votes to: AnLab, *Analog*, Davis Publications, Inc., 380 Lexington Ave., New York, NY 10017, before February 1, 1983.

—*The Editor*

a calendar of analog upcoming events

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14-16 January
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14-16 January
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24-26 January
10th Annual Symposium on Principles of Programming Languages (ACM SIGACT-SIGPLAN) at Austin, Texas. Info: Allen Emerson, Department of Computer Science, University of Texas, Austin TX 78712.

24-27 January
General meeting of the American Physical Society at New York, N.Y. Info: A.P.S., 335 East 45th Street, New York, NY 10017.

1-5 September
CONSTELLATION (41st World Science Fiction Convention) at Baltimore Convention Center, Baltimore, Md. Guest of Honor—John Brunner; Fan Guest of Honor—Dave Kyle; TM—Jack Chalker. Registration—$10 supporting at all times. Attending—$20 until 30 June 1982, more thereafter. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition, the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: ConStellation, 41st World Science Fiction Convention, Box 1046, Baltimore MD 21203.

—Anthony Lewis

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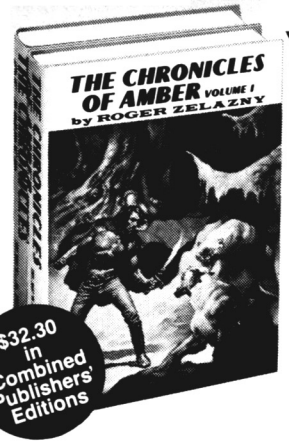

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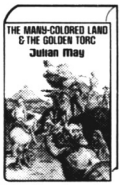

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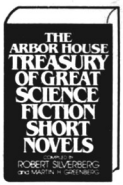

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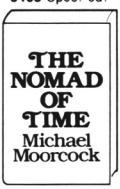

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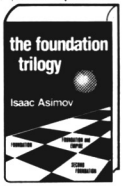

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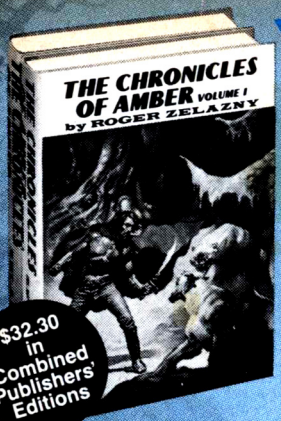

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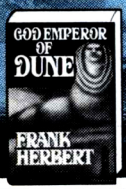

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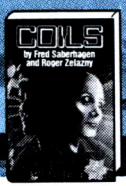

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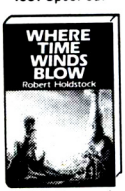

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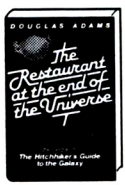

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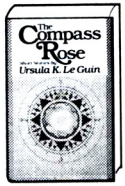

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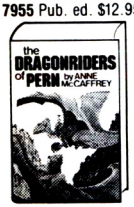

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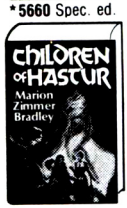

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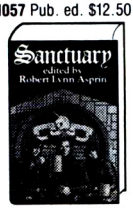

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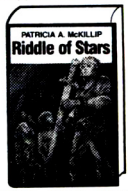

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