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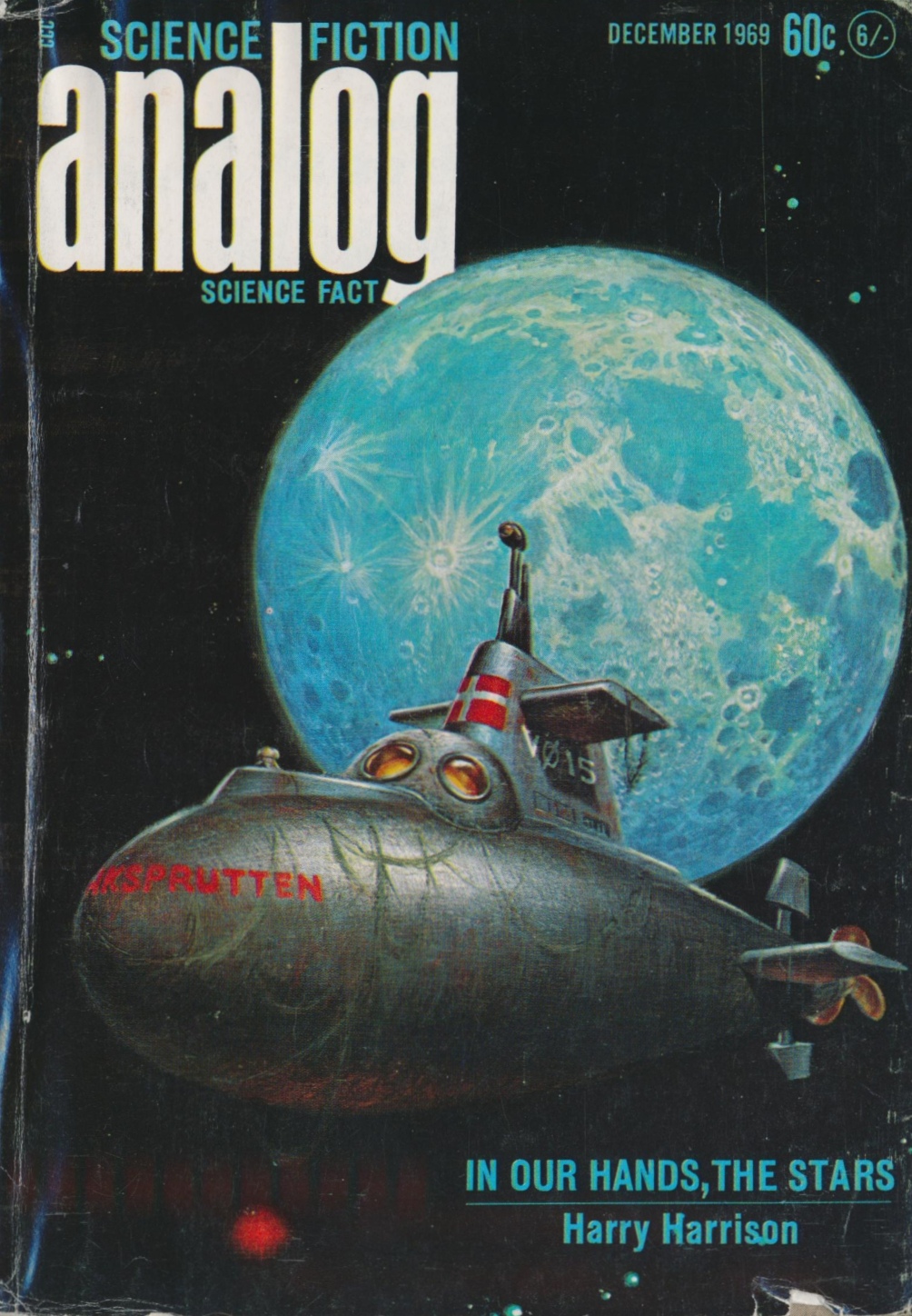

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Harry Harrison

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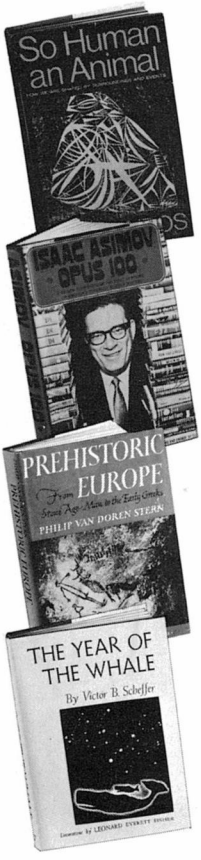

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men in space

editorial by John W. Campbell

Because President Kennedy had set a national goal of landing a man on the Moon and returning him safely, the whole Moon study program was slanted toward that end. The major problems Rangers, Surveyors and Orbiters were designed to answer concerned the safe landing of a manned vehicle on the Lunar surface. They were —no argument!—intended primarily not as ends in themselves, but as scouting gadgets for men to come.

They were, of course, necessarily research devices of great significance in and of themselves; to answer the question of the nature of the Lunar surface—was it floury dust thirty feet or more deep, in which vehicles could sink helplessly and hopelessly?—they had to make landings, and perform analyses. Surveyor's little electric power shovel, remote-controlled from a quarter million miles away, was essential. Rough chemical analysis, even, was tried. (I haven't found out why they didn't try neutron activation analysis; that seemed to me to be a fine technique for a very-remote-controlled chemical analysis technique.)

Orbiters, besides doing a bang-up job of studying the topography of the proposed landing sites, just happened, also, to do a magnificent job of studying the back side of the Moon.

Now comes the greater problem of planetary studies—and the usual loud and deeply convinced arguments between the manned-exploration advocates and the unmanned-instrument advocates.

A little consideration of human history—i.e., human nature as revealed by actual behavior, rather than theoretical notions of how men ought to act!—shows that the unmanned probe faction will inevitably and most certainly lose in the long run.

The reason's simple enough; men are never truly satisfied until they've *experienced* the reports themselves. No matter how much information an unmanned probe returns from Mars, no scientist is

going to be really satisfied until a human being, with all his observational capabilities, lands there and (1) *feels* Mars himself, and (2) brings some of Mars back to Earth for other men to feel and analyze.

And that doesn't mean one expedition landing in one place on Mars.

Consider this: Apollo 11 landed in the area of the Sea of Tranquillity, picked up a few pounds of local surface rocks, dust, and cores a few inches deep. These rocks turned out to have unusually high titanium content, and to show definite signs of being igneous—i.e., once molten and now frozen—material.

Now let us assume that EEM—Earth Excursion Module—has been landed on Earth near the edge of one of the great flat blue areas of the planet, by the investigating Aliens. (After Mariner IV, VI and VII it's a little difficult to talk about Martian probes!) The area they've happened to pick is a beach in Australia. Their astronauts pick up samples, describe what they see, and report back with information that Earth is made up of vast expanses of a very dark almost black sandy material, among the sand grains being occasional light-colored fragments of material that is very evidently a residue left by living organisms. The living material is largely composed of calcium carbonate and a protein binder material, but the inorganic surface of the planet is almost entirely titanium dioxide. A remarkable and unexpected chemical structure indeed—it requires the physicists and chemists and nucleogenesis experts, and the cosmologists, to make massive reevaluations to explain this enormously high abundance of titanium.

So . . . they happened to land on one of Australia's titanium beaches. It's a major world source of Ti for industry because the stuff's so accessible.

Some yahoo discussing the Moon rock findings on TV said that Ti was "a rare element on Earth." It happens to be the fifth most common metal, and the ninth most common element; Ti metal equipment—tough, strong, light, and extremely resistant to corrosion—is relatively rare not because the element is rare, but because processing the immense supplies of TiO_2 to get useful metal from it is a long, difficult, and frustrating problem. It's an element that's easy to find—but hard to do anything with, except to make high-purity TiO_2 as the whitest of white pigments.

The essential point is that landing in *one small area,* you could make the discovery that almost any element was "very plentiful on this planet."

There is only one spot known on Earth where cadmium occurs as a

mineral in its own right—Greenock, Scotland. The mineral's been named greenockite; it isn't known to occur anywhere else on Earth. Commercial cadmium derives from what amounts to a trace impurity in zinc ore.

Certain streams in the Andes mountains yielded platinum-iridium nuggets weighing hundreds of pounds, as well as more ordinary nuggets and finer bits.

There's a mountain in Colorado that's composed to a large extent of molybdenum ore. A one-spot landing party could get some unusual ideas of Earth's composition.

On the other hand, the Australian continent seems to be almost devoid of selenium—so much so that mammals are unable to get even the minute quantities of selenium essential to health.

While North America—seemingly alone of all the Earth's continents!—has so much that, in some areas, animals are poisoned by the excessive selenium content of plants growing in the soil.

As to that igneous rock . . . O.K., so the stuff was melted and then froze. This proves a hot inner core, like Earth's, that sends molten magma flowing out across the surface of the planet?

The *maria* of the Moon—and perhaps the "seas" of Mars—appear to have been caused by gigantic meteor impacts. It's been computed that the great Mare Imbrium was the result of the impact of something about one hundred miles in diameter, coming in at around two miles per second—the fall-from-infinity velocity for something hitting the Moon.

This means a happening that's quite unimaginable in its violence; the appalling explosive crash of worlds colliding—and the whole awesome explosion continuing on and on and on for fifty full seconds. The explosion of a hundred megaton fusion bomb would pass unnoticed in that catastrophe—and the violence would continue unabated for fifty seconds.

It can reasonably be predicted that the heat energy released, as that immense energy was gradually redistributed, would fuse thousands of cubic miles of rock. There'd be molten magma all right—but it wouldn't require any innate volcanic activity on the part of the planet to supply the heat of fusion!

Most of the Lunar *maria* seem to be underlain by "mascons"—mass concentrations—great enough to markedly distort the Moon's gravitational field. It suggests that under those *maria* lie something that's *big*, and markedly denser than the silicate rocks of the Moon generally. Perhaps the remains of stupendous masses of nickle-iron meteors that plowed into the rock, driving miles below the surface before their vast store of kinetic energy was all degraded to heat.

Certainly that could explain oceans of molten rock flooding out across the surface of the planet, drowning mountain ranges as the whole planet bulged to make room for the newly added hundred-mile sphere of matter.

One landing, in one place, on a known area of a *maria* isn't going to settle the question of what *caused* the lunar rocks to melt and flow. It could be an outwelling of native deep magma—but it could also be the result of the furious impact of planetoids.

Manned expeditions to the Moon will continue; they'll land in other areas, and every landing and exploration will reduce the chance that we have a misguided notion of the Moon's composition resulting from landing on an accidental ore body spot. We *could* have landed, by accident, on the Lunar equivalent of that Australian titanium beach; land a dozen times in a dozen widely separated places and we'll have a lot greater reason for confidence in our results.

But then comes the question of manned or only instrumented probes to other planets.

In only one case is the answer pretty certainly going to be "instruments only!" for a very long time to come—Venus. With over one hundred atmospheres pressure, nearly a ton per square inch, of dense, hot gas, and a temperature of molten lead, a ship capable of

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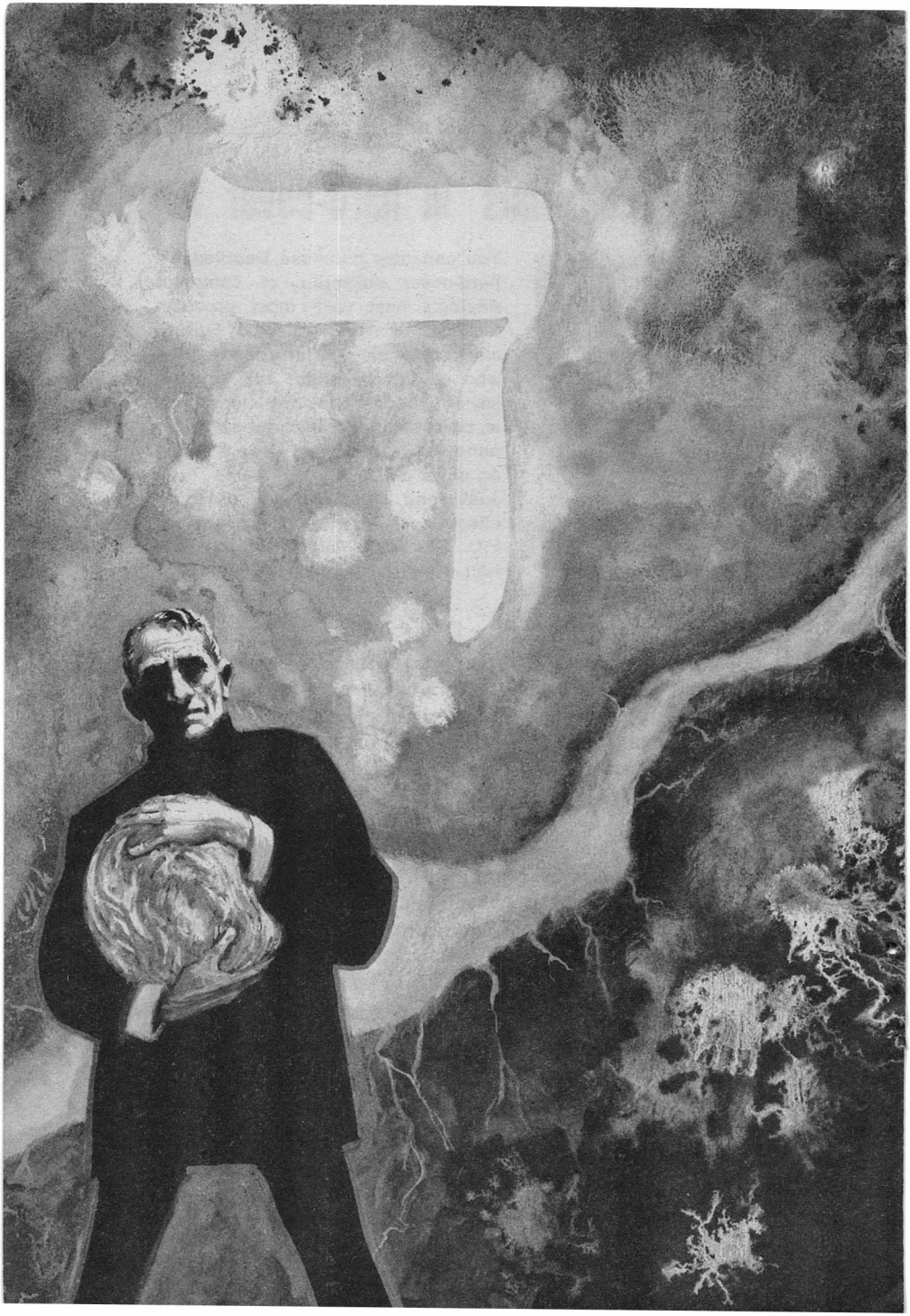
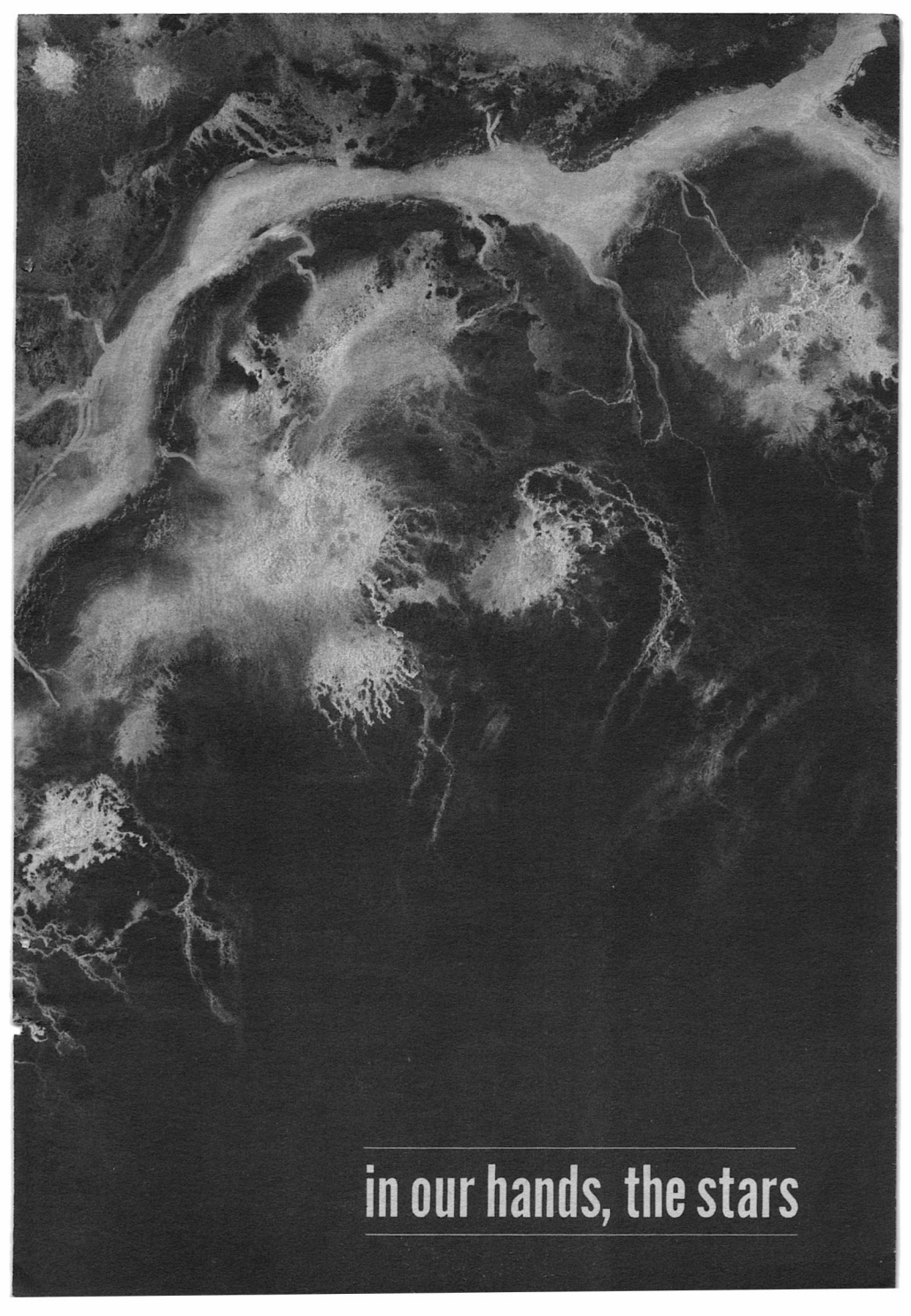



in our hands, the stars

First of Three Parts

Hydrogen bombs were soothing syrup and tranquilizers beside what he's discovered—the secret of the quasars! But all were innocuous compared to the international political tensions that discovery triggered . . .

HARRY HARRISON

Illustrated by Kelly Freas

I

The explosion that blew out the west wall of the Physics Laboratory of the University of Tel-Aviv did little real harm to Professor Arnie Klein who was working there at the time. A solid steel workbench protected him from the blast and flying debris, though he was knocked down and cut his cheek as he fell. He was understandably shaken as he climbed to his feet again, blinking at tht blood on his fingertips where he had touched his face. The far side of the laboratory was just rubble and twisted wreckage, with wreaths of dust or smoke curling up from it.

Fire! The thought of this stirred him to motion. The apparatus had been destroyed but his records of the experiment and his notes might still be saved. He tugged wildly at the drawer, bent and warped by the blast, until it squealed open. There it was, a thin file folder, a few weeks work—but how important. Next to it a worn folder, fifteen centimeters thick, six years of concentrated labor. He pulled them both out and, since the opening in the wall was close at hand, he went out that way. His records must be made secure first; that was the most important thing.

The pathway here at the back of the building was seldom used, and was deserted now in the breathless heat of the afternoon. This was a shortcut that had been physically impossible to reach from the laboratory before, but now led directly to the faculty dormitory close by. The file would be safe in his room. He hurried there, as fast as one can hurry when the dry, furnace-like wind of the khamsin is

blowing. Because he was already deep in thought he did not realize that his movements were completely unobserved.

Arnie Klein appeared slow witted to many people, but this was only because he was constitutionally unable to follow more than one train of thought at a time, and he had to chew this thought out with methodical thoroughness until every drop of nourishment had been extracted. His mind worked with meticulous precision and ground incredibly fine. Only this unique ability had kept him firmly on this line of reasoning for six years, a complicated chain of mathematical supposition based only upon a gravitometric anomaly and a possible ambiguity in one of Einstein's basic field-theory equations.

Now his mind was occupied with a new train of speculation, one he had considered before, but which the explosion had now proven to be a strong possibility. As usual, when deeply involved in thought, his body performed routine operations with, in truth, his conscious mind being completely unaware of them. His clothing was dusty from climbing the debris, as were his hands, and there was blood on his face. He stripped and automatically took a shower, cleaned the cut and applied a small bandage. Only when he began to dress again did his conscious mind intervene. Instead of putting on clean shorts he took the trousers of his lightweight suit from their hanger and slipped them on. He put a tie in the jacket pocket and draped the jacket across a chair. After this he stopped, in silence for some minutes, while he worked out the logical conclusions of this new idea. A neat, gray-haired man in his early fifties, looking very ordinary, if one made allowance for the fact that he stood for ten minutes, unblinking and motionless, until he reached that conclusion.

Arnie was not sure yet what would be the wisest thing, but he knew what the alternative possibilities were. Therefore he opened his attaché case, still on the dresser where he had put it upon his return from the Belfast Physical Congress the previous week, which contained a book of Thomas Cook & Sons travelers checks. It was very full because he had thought he would have to pay for his airplane tickets and be reimbursed, but instead the tickets had arrived prepaid.

Into the attachè case he put the file folder and his passport, with its visas still in effect; nothing else. Then, with his jacket folded neatly over his arm and carrying the attaché case, he went down the stairs and walked towards the waterfront.

Less than a minute later two excited students ran, sweating and breathless, up to his room and hammered on the door.

The khamsin blew with unobstructed relentlessness once he was away from the protection of the campus buildings, drawing the moisture from his body. At first Arnie did not notice this but, in Dizengoff Road, passing the cafés, he became aware of the dryness in his mouth and he turned into the nearest doorway. It was the Casit, a bohemian, left-bank sort of place, and no one in the variegated crowd even noticed him as he sat at a small table and sipped his *gazos*.

It was there that his chain of thought unreeled to its full length and he made up his mind. In doing this he was completely unaware of any outside influences, and had no idea that an alarmed search was being carried out for him, that waves of consternation were spreading out from the epicenter of the university. At first it had been thought that he was buried under the debris caused by the mysterious explosion, but rapid digging disproved that idea. Then it was discovered that he had been in his room, his soiled clothing was found as well as traces of blood. No one knew what to believe. Had he been hurt and was he wandering in shock? Had he been abducted? The search widened, though it certainly never came near the Casit café. Inside, Arnie Klein stood up, carefully counted out enough *prutot* coins to pay for his drink, and left.

Once again luck was on his side. A taxi was letting out a fare at Rowal's, the sophisticated café next door, and Arnie climbed in while the door was still open.

"Lydda Airport," he said, and listened patiently while the driver explained that he was going off duty, that he would need more petrol, then commented unfavorably on the weather and a few other items as well. The negotiations that followed were swift because, now that he had come to a decision, Arnie realized that speed would avoid a great deal of unpleasantness.

As they started towards the Jerusalem road two police cars passed them, going in the opposite direction at a tremendous pace.

II

The hostess had to tap his arm to get his attention.

"Sir, would you please fasten your seatbelt?"

"Yes, of course," Arnie said, fumbling for the buckle. He saw now that the seatbelt and no smoking signs were both lit.

The flight had passed very quickly for him. He had vague memories of being served dinner, although he could not remember what it was. Ever since taking off from Lydda Airport he had been absorbed in computations that grew out of that last and vital experiment. The time had passed very swiftly for him.

With slow grandeur, the big 707 jet tipped up on one wing in a stately turn and the moon moved like a beacon across the sky. The clouds below were illuminated like a solid yet strangely unreal landscape. The airliner dropped, sped above the nebulous surface for a short time, then plunged into it. Raindrops traced changing pathways across the outside of the window. Denmark, dark and wet, was somewhere down below. Arnie saw that his notebook, the open page covered with scribbled equations, was on the table before him. He put it into his breast pocket and closed the table. Points of light appeared suddenly through the rain and the dark waters of the Øresund streamed by beneath them. A moment later the runway appeared and they were safely down in Kastrup Airport.

Arnie waited patiently until the other passengers had shuffled by. They were Danes for the most part, returning from sunshine holidays, sun-reddened faces glowing as though about to explode. They clutched straw sacks and oriental souvenirs; wooden camels, brass plates, exfoliating rugs, and each had the minuscule, tax-free bottle of alcoholic spirits that their watchful government permitted them to bring in. Arnie went last, paces behind the others. The cockpit door was open as he passed, revealing a dim hutch incredibly jammed with shining dials and switches. The captain, a big blond man with an awe-inspiring jaw, smiled at him as he passed. *Capt. Nils Hansen* the badge above his wings read.

"I hope you enjoyed the flight," he said in English, the international language of the airways.

"Yes indeed, thank you. Very much." Arnie had a rich British public school accent, entirely out of keeping with his appearance. But he had spent the war years at school in England, at Winchester, and his speech was marked for life.

All of the other passengers were queued up at the custom booths, passports ready. Arnie almost joined them until he remembered that his ticket was written through to Belfast and that he had no Danish visa. He turned down the glass-walled corridor to the transit lounge and sat on one of the black leather and chrome benches while he thought, his attaché case between his legs. Staring unseeing into space he considered his next steps. In a few minutes he had reached a decision, and he blinked and looked about. A police officer was striding through the lounge, massive in his high leather boots and wide cap. Arnie approached him, his eyes almost on a level with the other's silver badge.

"I would like to see the chief security officer here, if you would."

The officer looked down, frowning professionally.

"If you will tell me what the matter is . . ."

"Dette kommer kun mig og den vagthavende officer ved. Så må jeg tale med ham?"

The sudden, rapid Danish startled the officer.

"Are you Danish?" he asked.

"It does not matter what my nationality is," Arnie continued in Danish. "I can tell you only that this is a matter of national security and the wisest thing for you to do now would be to pass me over to the man who is responsible for these matters."

The officer tended to agree. There was something about the matter-of-factness of the little man's words that rang of the truth.

"Come with me then," he said, and silently led the way along a narrow balcony high above the main airport hall, keeping a careful eye open so that the stranger with him made no attempt to escape to the rain-drenched freedom of the Kastrup night.

"Please sit down," the security officer said when the policeman had explained the circumstances. He remained seated behind his desk while he listened to the policeman, his eyes, examining Arnie as though memorizing his description, staring unblinkingly through round-paned, steel-framed glasses.

"Løjtnant Jørgensen," he said when the door had closed and they were alone.

"Arnie Klein."

"Må jeg se Deres pas?"

Arnie handed over his passport and Jørgensen looked up, startled, when he saw it was not Danish.

"You are an Israeli then. When you spoke I assumed . . ." When Arnie didn't answer the officer flipped through the passport, then spread it open on the bare desk before him.

"Everything seems to be in order, Professor. What can I do for you?"

"I wish to enter the country. Now."

"That is not possible. You are here in transit only. You have no visa. I suggest you continue to your destination and see the Danish Council in Belfast. A visit will take one day, two at the most."

"I wish to enter the country now, that is why I am talking to you. Will you kindly arrange it? I was born in Copenhagen. I grew up no more than ten miles from here. There should be no problem."

"I am sure there won't be." He handed back the passport. "But there is nothing that can be done here, now. In Belfast . . ."

"You do not seem to understand." Arnie's voice was as impassive as his face, yet the words seemed charged with meaning. "It is imperative that I enter the country now, tonight. You must arrange something. Call your superiors. There is the question of dual nationality. I am as much a Dane as you are."

"Perhaps." There was an edge of exasperation to the lieutenant's voice now. "But I am not an Israeli citizen and you are. I am afraid you must board the next plane. . ."

His words trickled off into silence as he realized that the other was not listening. Arnie had placed his attaché case on his knees and snapped it open. He took out an address book and opened it.

"I do not wish to be melodramatic, but my presence here can be said to be of national importance. Will you, therefore, place a call to this number and ask for Professor Ove Rude Rasmussen? You have heard of him?"

"Of course, who hasn't? A Nobel prize winner. But you cannot disturb him at this hour . . ."

"We are old friends. He will not mind. And the circumstance is serious enough."

It was after one in the morning and Rasmussen growled at the phone like a bear roused from hibernation.

"Who is that? What's the meaning . . . *Så for Satan!* . . . is that really you, Arnie? Where the devil are you calling from? Kastrup?" Then he listened quietly to a brief outline of the circumstances.

"Will you help me then?" Arnie asked.

"Of course! Though I don't know what I can possibly do. Just hold on, I'll be there as soon as I can pull some clothes on."

It took almost forty-five minutes and Jørgensen felt uncomfortable at the silence, at Arnie Klein staring, unseeing, at the calendar on the wall. The security officer made a big thing of snapping open a package of tobacco, of filling his pipe and lighting it. If Arnie noticed this, he gave no sign. He had other things to think about. The security officer almost sighed with relief when there was a quick knocking on the door.

"Arnie—it really is you!"

Rasmussen was like his pictures in the newspaper: a lean, gangling man, his face framed by a light, curling beard, without a moustache. They shook hands strongly, almost embracing, smiles mirrored on each other's faces.

"Now tell me what you are doing here, and why you dragged me out of bed on such a filthy night?"

"It will have to be done in private."

"Of course." Ove looked around, noticing the officer for the first time. "Where can we talk? Some place secure?"

"You can use this office if you wish. I can guarantee its security." They nodded agreement, neither seemingly aware of the sarcastic edge to his words.

Thrown out of his own office—what the *hell* was going on? The lieutenant stood in the hall, puffing angrily on his pipe and tamping the coal down with his cal-

loused thumb, until the door was flung open ten minutes later. Rasmussen stood there, his collar open and a look of excitement in his eyes. "Come in, come in!" he said and almost pulled the security officer into the room, barely able to wait until the door was closed again.

"We must see the Prime Minister at once!" Before the astonished man could answer he contradicted himself. "No, that's no good. Not at this time of night." He began to pace, clenching and unclenching his hands behind his back. "Tomorrow will do for that. We have to first get you out of here and over to my house." He stopped and stared at the security officer.

"Who is your superior?"

"Inspector Anders Krarup."

"I don't know him, no good. Wait, your department, the minister . . ."

"Herr Andresen."

"Of course—Svend Andresen. You remember him, Arnie?"

Klein considered, then shook his head *no*.

"Tiny Anders, he must be over two metres tall, he was in the upper form when we were at Krebs' Skole. The one who fell through the ice on the Sortedamissø."

"I never finished the term. That was when I went to England."

"Of course. But he'll remember you, and he'll take my word for the importance of the matter. We'll have you out of here in an hour, and then a glass of *snaps* into you and you into bed."

It was a good deal more than an hour, and it took a visit by a not-too-happy Minister Andresen, and a hurriedly roused aide, before the matter was arranged. The small office was filled with big men, and the smell of damp wool and cigar smoke, before the last paper was stamped and signed. Then Lieutenant Jørgensen was finally alone, feeling tired and more than a little puzzled by the night's events, his head still filled with the Minister's grumbled advice to him, after taking him aside for a moment.

"Just forget the whole thing, that's all you have to do. You have never heard of Professor Klein and to your knowledge he did not enter the country. That is what you will say no matter *who* asks you."

Who indeed? What was all the excitement about?

III

"I really don't want to see them," Arnie said. He stood by the high window looking out at the park next to the university. The oak trees were beginning to change color already; fall came early to Denmark. Still, there was an excitement to the scene with the gold leaves and dark trunks against the pale northern sky. Small puffs of white clouds moved with stately grace over the red-tiled roofs of

the city: students hurried along the paths to classes.

"It would make things easier for everyone if you would," Ove Rasmussen said. He sat behind his big professor's desk, in his book-lined professor's office, his framed degrees and awards like heraldic flags on the wall behind him. Now he leaned back in his deep leather chair, turned sideways to watch his friend by the window.

"Is it that important?" Arnie asked, turning about, hands jammed deep into the pockets of the white laboratory coat. There were smears of grease on one sleeve and a brown-rimmed hole in the cuff where a soldering iron had burned through.

"I'm afraid it is. Your Israeli associates are very anxious to find out what happened to you. I understand they traced your movements through a cab driver. They have discovered that you flew by SAS to Belfast—but that you never arrived there. Since the only stopover was here in Copenhagen it was rather hard to conceal your whereabouts. Though I hear that the airport people did give them a very hard time for a while."

"That Lieutenant Jørgensen must have earned his salary."

"He did indeed. He was so bull-headed that there was almost an international incident before the Minister of State admitted that you were here. Now they insist upon talking to you."

"Why? I am a free man. I can go where I please."

"Tell them that. Dark hints about kidnapping have been dropped—"

"What! Do they think that the Danes are *Arabs* or something like that?"

Ove laughed and twisted about in his chair as Arnie stamped over and stood before the desk.

"No, nothing like that," he said. "They know—unofficially, of course—that you came here voluntarily and that you are unharmed. But they are very curious as to *why* you have come here, and they are not going to go away until they have some answers. There is an official commission right now in the Royal Hotel. They say they will make a statement to the press if they don't see you."

"I do not want that to happen," Arnie said, worried now.

"None of us do. Which is why they want you to meet the Israelis and tell them that you are doing fine and they can take the next flight out. You don't have to tell them any more than that."

"I do not *want* to tell them any more than that. Who have they sent?"

"Four people, but I think three of them are just yes-men. I was with them most of the morning and the only one who really mattered was a General Gev . . ."

"Good God! Not Gev."

"You know him?"

"Entirely too well. And he knows me. I would rather talk to anyone else."

"I'm afraid you're not getting that chance. Gev is outside right now waiting to see you. If he doesn't talk to you, he says he is going straight to the press."

"You can believe him. He learned his fighting in the desert. The best defense is a good offense. You had better show him in here and get it over with. But don't leave me alone with him for more than fifteen minutes. Any more than that and you may find that he has talked me into going back with him."

"I doubt that." Ove stood and pointed to his chair. "Sit here and keep the desk between you. It gives one a feeling of power. Then he'll have to sit on my student-chair there which is hard as flint."

"If it were a cactus, he would not mind," Arnie said, depressed. "You do not know him the way I do."

There was silence after the door closed. An occasional shout from the students outside penetrated the double-glass window, but only faintly. Inside the room the ticking of the tall Bornholm clock could be heard clearly. Arnie stared, unseeing, at his folded hands on the desk before him and wondered what to do about Gev. He had to tell him as little as possible.

"It's a long distance to Tel-Aviv," a voice said in guttural Hebrew and Arnie looked up, blinking, to see that Gev was already inside the room and had closed the door behind him. He was in civilian clothes but wore them, straight-backed, like a uniform. His face was tanned, lined, dark as walnut: the long scar that cut down his cheek from his forehead pulled the corner of his mouth into a perpetual half-grin.

"Come in, Avri, come in. Sit down."

Gev ignored the invitation, stamping across the room, on parade, to stand over Arnie, scowling down at him as though he had been inspected and found wanting.

"I've come to take you home, Arnie. You are one of our leading scientists and your country needs you."

There was no vacillation, no appeal to Arnie's emotions, to his friends or relations. General Gev had issued an order, in the same voice that had commanded the tanks, the jets, the soldiers into combat. He was to be obeyed. Arnie almost rose from his chair and followed him out, so positive was the command. Yet he only stirred uncomfortably in the chair. His decision had been made and nothing could be done about it.

"I am sorry, Avri. I am here and I am going to stay here."

Gev stood, glowering down on

him, his arms at his sides but his fingers were curved, as though ready to reach out and grasp and pull Arnie bodily to his feet. Then, in instant decision, he turned and sat down in the waiting chair and crossed his legs. His frontal assault had been repulsed; he turned the flank and prepared to attack in a more vulnerable area. Never taking his eyes from Arnie he took a vulgarly large, gold cigarette case from his pocket and snapped it open. The flag of the United Arab Republic was set into the case in enamel, the two green stars picked out with emeralds. A bullet hole punched neatly through the case.

"There was an explosion in your laboratory," Gev said. "We were concerned. At first we thought you were dead, then injured—then kidnapped. Your friends have been very concerned . . ."

"I did not mean them to be."

". . . And not only your friends, your government. You are an Israeli, and the work you do is for Israel. A file is missing. Your work has been stolen from your country."

Gev lighted a cigarette and drew deeply on it, cupping the burning end in his hand, automatically, the way a soldier does. His eyes never left Arnie's face and his own face was as expressionless as a mask, with only those accusing eyes peering through. Arnie opened his hands wide in a futile gesture, then clasped them.

"The work has not been stolen. It is my work and I took it with me when I left— when I left voluntarily, to come here. I am sorry that you . . . think ill of me. But I did what I had to do."

"What was this work?" The question was cold and sharp, and cut deep.

"It was . . . my work." Arnie felt outmaneuvered, outfought, and could only retreat into silence.

"Come now, Arnie. That's not quite good enough. You are a physicist and your work has to do with physics. You had no explosives, yet you managed to blow up some thousands of pounds worth of equipment. What have you invented?"

The silence lengthened and Arnie could only stare miserably at his clenched hands, his knuckles whitening with the pressure. Gev's words pulled at him, relentlessly.

"What is this silence? You can't be afraid? You have nothing to fear from Israel, your homeland. Your very life is there . . . your friends, your work. You buried your wife there. Tell us what is wrong and we will help you. Come to us and we will aid you."

Arnie's words fell like cold stones into the silence.

"I . . . cannot."

"You have to, you have no other choice. You are an Israeli and your work is Israeli. We are surrounded by an ocean of enemies and every

man, every scrap of material is vital for our existence. You have discovered something powerful, something that will aid our survival. Would you remove it and see us all perish—the cities and the synagogues leveled to be a desert again? Is that what you want?"

"You know that I do not! Gev, let me be, get out of here and go back . . ."

"That I *won't* do. I won't let you be. If I am the voice of your conscience, so be it. Come home. We will welcome you. Help us as we helped you."

"No! That is the thing I cannot do!" The words were pulled from his body, a gasp of pain. He went on, quickly, as though the dam to his feelings had been broken and he could not stop.

"I have discovered something, I will not tell you how, why, what it is . . . a force. Call it a force, something that is perhaps more powerful, or could be more powerful than anything we know today. A force that can be used for good or evil because it is by nature that sort of thing, if I can develop it, and I think I can. I want it used for good—"

"Israel is evil! You dare suggest that?"

"No, hear me out, I did not say that. I mean only that Israel is the pawn of the world with no one on their side. Oil. The Arabs have the oil and the Soviets and the Americans want it and will play any dirty game to get it. No one cares for Israel, except the Arabs who wish to see her destroyed, and the world powers who also wish they could find a way to destroy her quietly, the thorn in their sides. Oil. War will come, something will happen, and if you have my . . . if you had *this,* what we are talking about, it would be used for destruction. You would use it, with tears in your eyes perhaps, but you would use it and that would be absolute evil."

"Then," General Gev said, in a voice so low it was scarcely audible, "from pride, personal ambition, you will withhold this force and see your country perish? In your supreme egocentricity you think yourself more fit to make major policy decisions than the elected representatives of the people. You put yourself on a pedestal. You are unique. Better able to decide the important issues than all the lesser mortals of the world. You must believe in absolute tyranny —*your* tyranny. In your arrogance you become a little Hitler . . ."

"Shut up!" Arnie shouted hoarsely, half rising from the chair. There was silence. He sat down again, slowly, aware that his face was flushed, a pulse hammering like a rivet gun in his temple. It took a great effort to speak calmly.

"All right. You are correct in what you say. If you wish to say that I no longer believe in democracy, say it. In this matter I don't.

I have made the decision and the responsibility is mine alone. To myself, perhaps as an excuse, I prefer to think of it as a humane act . . ."

"Mercy killing is also humane," Gev said in a toneless voice.

"You are right, of course. I have no excuses. I have acted willfully and I accept the responsibility—"

"Even if Israel is destroyed through you arrogance?"

Arnie opened his mouth to answer, but there were no words. What could be said? Gev had him hemmed in from all sides, his retreat was cut off, his defenses destroyed. What could he do other than surrender? All that remained was the persistent conviction that, in the long run, he was doing the right thing. A conviction that he was afraid to test, or examine, lest it prove false as well. The silence grew and grew and a great sadness pushed down on Arnie so that he slumped in his chair.

"I do what I have to do," he said, finally, in a voice hoarse with emotion. "I will not return. I have left Israel as I came, voluntarily. You have no hold on me, Gev."

General Gev stood up, looking down upon the bowed head. His words were slow in coming and, when he did speak, there was the echo of three thousand years of persecution, of death, of mourning, of a great, great sadness.

"You, a Jew, you could do this . . . ?"

There was no possible answer and Arnie remained silent. Gev was soldier enough to see defeat even though he could not understand it. He turned his back, he said nothing more, though what more could be said than this act of turning his back and leaving? He pushed the door open with his fingertips and did not touch it again, to close it or even slam it, but went straight out. Upright, marching, a man who had lost a battle, but who would never lose a war without dying first.

Ove came in and puttered around the room, stacking the magazines, pulling out a book then putting it back unopened, doing this for some minutes in silence. When he finally spoke it was about something else.

"Listen, what a day it is out. The sun's shining, you can see for miles. You can see the girls' skirts blowing up when they ride their bicycles. I've had enough of this filthy cafeteria food, I'm stuffed solid right up to here with *rugbrød*. I can't face another sandwich. Let's go to Langelinie Pavillonen for lunch. Watch the ships sail by. What do you say?"

There was a stricken look on Arnie's face when he raised his head He was not a man normally given to strong emotions of any kind and he had no defenses, no way of dealing with what he now felt. There was the pain—written so

clearly on his face that Ove had to turn away and push about the magazines so recently ordered.

"Yes, if you want to. We could have lunch out." His voice was as empty of emotion as his face was lined with it.

They drove in silence down Nørre Alle and through the park. It was indeed as Ove had said. The girls were on their high black bikes, flashes of color among the drab jackets of the men, pacing the car on the bicycle paths that bordered the wide street, sweeping in ordered rows across the intersections. Their long legs pumped and their skirts rode up freely and it was a lovely afternoon. Except that Arnie carried with him the memory of a great unhappiness. Ove twisted the little Sprite neatly through the converging traffic at Trianglen and down Østerbrogade to the waterfront. The car shot through a gap in the Langelinie traffic and braked under the rear of Pavillonen restaurant. They were early enough to get a table at the great glass window that formed one wall. Ove beckoned to the waiter and ordered before they sat down. Even as they were pulling up their chairs a bottle of akvavit appeared, frozen in a block of ice, and a brace of frosted bottles of Tuborg Fine Festival beer.

"Here," Ove said, as the waiter poured out two of the thimble-sized glasses of chilled *snaps*. "Drink this."

"Skål," they said in ritual unison, and drained the glasses.

Arnie sipped at his beer afterwards and looked out at the black and white ferry to Sweden, plowing ponderously by. The buses were pulled up in a waiting row while the tourists clambered over the rocks for a ritual visit to the Little Mermaid, cameras eagerly ready. Beyond them the white sails of tiny yachts from the basin cut across the cold blue of the Sound. The sea. You could not go more than forty miles from it in Denmark, a sea-faring sea-girt nation if there ever was one. The white triangles of sails were dwarfed by a great liner tied up at Langeliniekaj. Flags and pennants gave her a rakish holiday air, and a sudden burst of steam rose from her front funnel. Moments later the distant moan of her horn could be dimly heard.

"A ship," Arnie said and now, considering his work once again, all trace of what he had been feeling seemed to have vanished. "We need a ship. When we want to try out a larger . . ." He hesitated and they both looked around with their eyes only, like conspirators, and when he went on it was in a lower voice.

"A larger unit. The first one is too small, a demonstration of theory only. But a big unit will have to be tested on a large scale, to see if we have anything here other than a stupid laboratory demon-

stration that blows up equipment."

"It will work. I know that it will work."

Arnie twisted his mouth wryly and reached for the bottle.

"Have some more *snaps*" he said.

IV

"It is a matter of security," Skou said. He had a first name, Langkilde, but he never mentioned it, perhaps with good reason. "Skou," he insisted, "just call me Skou." As though welcoming all men to the informal friendship of a world-wide billiard parlor. *"Go' davs, Hansen—Go' davs, Rasmussen—Go' davs, Skou."* Although he insisted that he was just plain Skou to all men, he was most correct with others.

"We must always take security seriously, Herr Professor Rasmussen," he insisted, his eyes watching everything while he talked. "You have something that requires security, therefore you must have security at all times."

"What we have here . . ."

"Don't tell me, I insist. The fewer who know, the fewer who can tell. Just permit me my security arrangements, and go about your work without a worry."

"Goodness, man, I have no worry. We've only started work recently and no one knows about the project yet."

"Which is the way it should be. I prefer to be in at the beginning or even before the beginning to make my arrangements. If they don't learn one thing, they won't learn anything."

He had the knack for constructing pseudo-colloquialisms that made him appear a bit of a fool, which he definitely was not. When he stood, hands stuffed into the pockets of his well-worn tweed jacket, he canted at an angle like a perpetual half-drunk. His blank face and sandy, thinning hair helped this illusion. Ove knew that it was illusion only. Skou had been a police officer for years, his German was perfect and he had been a rather despised collaborator and card-playing companion of the occupying Germans in Helsingør during the war. He had also been head of the underground in that area and the angle of his stance had something to do with being shot by his former drinking companions, then escaping out of a second-story hospital window before they got around to questioning him too closely. Now he was connected with some government bureau, he was never too clear about it, but it added up to security and he got his way whenever he wanted it. He had been in and out of the labs for over a month, enforcing some rules and operations, so what was meant to be private was kept private.

"This all seems very cinematic, Herr Skou," Arnie said. "If we just put the unit in a truck and cover

it up, no one would ever notice."

"Skou, if you please. The unreal borrows from the real, the cinema from life, if you know what I mean. And maybe we can learn a thing or two from them. It is best to take precautions. A matter of security."

Skou was not to be argued with. They waited, out of sight inside the Niels Bohr Institute building, while the red and black post office truck pulled up at the loading ramp outside. There was a certain amount of shouting when, backing in, it almost knocked over a stack of milk bottle crates, but with not too many *"Stop, Hendrik!"* and *"lidt endnu! Sä er den der!"* cries it put its back doors at the platform edge. Two postmen, bulky in their reddish-pink jackets and heavy with the thud of their wooden soled *træsko,* brought in some armloads of parcels. That they were more than postmen was apparent by their complete ignorance of the presence of the three watchers: no normal Danish postman could have resisted this opportunity for a chat. Skou silently pointed to the crates that contained the unit and, just as silently, they pushed them into the waiting van. The wide doors were closed, the big padlock sealed, and the truck rumbled its engine and moved out into the road. They watched it until it vanished in the morning traffic.

"Post trucks are not invisible, but they are the next best thing to invisible," Skou said. "They will go to the central office on Kϕbmagergade, along with many other trucks of the same shape and color. They will emerge a few minutes later—with new numbers, of course—and proceed to the quay. I suggest, gentlemen, that we proceed there to greet them upon arrival."

Skou drove them in his car, a disreputable Opel of uncertain age, and did a certain amount of cutting down narrow streets and darting in and out of traffic until he was sure that they were not being followed. He parked near the yacht basin and went to find a telephone while they walked on ahead. A biting wind keened in off the waters of the Ǿresund, directly from Sweden and the arctic beyond. The sky was low and gray.

"It feels like snow," Ove said.

"Is that the ship?" Arnie asked, looking towards the far end of Langelinie quay where a single vessel was tied up.

"Yes, the *Isbjorn.* It seemed the best for our needs. After all, we can't be too sure about stress and, old as she is, she's still an ice-breaker. I watched her half of last winter keeping the channel clear out here."

Two policemen, massive in their great, long coats, looked out towards Sweden and ignored them when they passed. As did two equally solid men in a car halfway down the quay.

"Skou has his watchdogs out," Ove said.

"I doubt they'll have much to do. In this weather not many sightseers will want to walk along here."

The ship loomed over them, a black wall studded with rows of bulging rivetheads. The gangplank was down, but no one was in sight on deck. They climbed up slowly, the ramp creaking beneath them.

"Quite an antique," Ove said once they had reached the deck. "But a little too dark to match her 'polar bear' name with all the soot." A thin ribbon of coal smoke rose from her stack from the furnace below.

"Old but strong," Arnie said, pointing at the massive reinforcing in the bows. "The new generation of icebreakers slide up onto the ice and break it with their weight. This old-timer does it the hard way by bashing right on through. This was a wise choice. I wonder where everyone is?"

As though summoned by his words the door to the pilot house swung open and an officer appeared there; as dark and brooding as the ship in his black coat and boots, a great piratical beard concealing the lower part of his face. He stomped over to them and executed a very perfunctory salute.

"I assume that you are the gentlemen I was told to expect. I am Captain Hougaard, the commander of this vessel." There was no warmth at all, in his tone or his manner.

They shook hands with him, embarrassed by Skou's instructions not to give their names.

"Thank you for having us aboard, Captain. It was very kind of you to make your ship available," Ove said, trying to be conciliatory.

"I had no choice." He was not in a peace-making humor. "I was ordered to do so by my superiors. My men are staying below as was also ordered."

"Very kind," Ove said, working hard to keep any sarcastic edge from his words. There was the thin squeal of brakes as the post office truck pulled up on the quay below; a welcome interruption. "Would you be so kind as to have some of your men bring up the packages from that truck?"

Captain Hougaard's only answer was to bellow commands down a hatchway, that brought a half-dozen sailors on the run. They were far more interested than the captain in what was happening, and perhaps grateful for the break in routine.

"Gently with those," Arnie said when they carried the boxes up the gangway. "They can't be dropped or jarred."

"Couldn't treat them more gently if my mother were inside," a blond giant of a seaman said. His wide sideburns vanished into an heroic moustache. He winked at

them when the captain wasn't looking.

They had gone over the blueprints of the ship and had selected the engine room as best suited to their needs. The bow end of the space was cut off, by a screened wall, into a room for the electrician, his supplies and workbench. The power board and generator were here and, equally important, the room was against the outer skin of the ship's hull. The boxes were brought here and, under the watchful eyes of the two physicists, were gently lowered to the deck. When all of the men had gone the captain stepped forward.

"I have been instructed that your work is to be done in absolute privacy. However, since one boiler must be fired an engineer will have to be stationed out here . . ."

"That's perfectly all right," Arnie broke in.

". . . And when the watch is changed I will change the men myself. I will be in my cabin if you wish to contact me."

"Fine, thank you for the aid, Captain." They watched his retreating back. "I am afraid he doesn't like all this," Arnie said.

"I'm afraid we can't afford to worry about it. Let's get these things uncrated."

Setting up the equipment took most of the day. There were four basic units, electronic equipment of some kind, unidentifiable in their dial-studded black metal cabinets. Heavy cables with multiple pronged connectors snaked between them, and an even thicker cable ran to the power outlet. While Arnie worried over the connections and adjustment of the equipment, Ove Rasmussen pulled on a pair of cotton workmen's gloves and studied the paint-encrusted rivet-littered hull of the ship.

"Right here," he said, tapping on a bulging rib with his hammer. He then went to work with steady precision, with hammer and chisel, removing the thick layers of paint that covered the steel. When he had a foot-long area cleaned right down to the bare, shiny metal he scrubbed it industriously with a wire brush.

"Done," he announced with satisfaction, pulling off the gloves and lighting a cigarette. "Clean as a whistle. Positive contact here and through the entire hull.

"I hope so. This connection is most vital."

A flexible, rectangular-cross sectioned wave guide protruded from what appeared to be the final unit in the interconnection, and terminated in a complicated bit of brass machining equipped with screw clamps. After a certain amount of filing of metal, and mumbled curses about the intractability of inert matter, they succeeded in fastening it to the prepared section of metal. Arnie made a number

of careful settings and switched on the equipment.

"Trickle power," he said. "Just enough to see if we are completing our circuitry."

There was a sudden sharp rapping on the door. Ove went and opened it a crack. Captain Hougaard was outside, looking as annoyed as ever.

"Yes?"

"There is a soldier here who wishes to speak to you." He did not appear to enjoy his role as messenger boy.

Ove opened the door just wide enough to slip out, then carefully closed it behind him. A uniformed sergeant, all web belts, brass clips, high boots, was holding the leather case of a field telephone; the cable from it vanished out of sight up the gangway.

"I was told to bring this to you, sir. The other unit is on the quay outside."

"Thank you, Sergeant. Just put it down here and I'll take care of it."

The door to the electrician's compartment opened and Arnie looked out.

"Could I talk to you, Captain?" he asked.

The captain pointed at the sergeant. "Wait for me on the deck above." He was silent until the man had clumped up the stairway out of earshot. "What is it?"

"We need some skilled help. Perhaps you have someone aboard who can weld—and do a good job? It will take a long time to send ashore for help. This is a matter of national interest," he added when the captain was silent, and appeared reluctant to answer.

"Yes, I'm very much aware of that. The Minister of Trade will have my complete report on this matter. There is Jens, he was a welder in the shipyard. I'll send him down." He went away, the very stomp of his feet radiating annoyance.

Jens turned out to be the moustache giant who had helped bring down the boxes. He appeared, swinging the heavy tanks of a gas welder like toys, smiling innocently.

"Now we get a look at the box of tricks, hey? No secrets from Jens, he sees all and tells nothing. Big mysterious secret affairs, Army, Navy, Marine—even Niels Bohr Institute like Herr Professor Rasmussen here." Both men looked shocked as the big man winked and dropped the pipes and tanks to the deck.

"Perhaps we had better contact . . ." Arnie said, but was interrupted by Jens's olympian laugh.

"Don't worry! See all, tell nothing. Jens has been in the Army in Greenland, in the shipyard, South America. On television I saw the professor here get the Nobel prize. Gentlemen, don't worry, I am as good a Dane as

they come, even if I was born in Jutland which some lousy Zealanders hold against me, and I even have the Dannebrog tattooed on my chest. Would you like to see it?"

He assumed they would, even before they had a chance to answer, and opened his jacket and shirt to show the white-crossed red flag of Denmark tucked away behind the golden waves of hair.

"That is very good," Arnie said —and shrugged. "I suppose we do not have much choice in the matter. I assume you will not talk about what you see here—"

"If the torturers pulled out every fingernail and toenail on my body, I would laugh and spit in their faces without saying a word."

"Yes, I am quite sure that you would. If you will come in here." They stood aside while the big man dragged his equipment in.

"It is the hull connection," Arnie told Ove. "Just not good enough. The signal is not getting through. We will have to weld the wave guide to it."

Jens nodded while they explained what must be done, and his welder popped, then hissed to life. He knew his work all right, the captain had not been wrong about that. After removing the wave guide he brushed the area clean again and scrubbed it with solvent. Only then did he clamp the brass fitting back on and run a true and steady bead down its length, humming cheerfully to himself while he worked.

"Strange looking radios you have here," he said, flashing a brief look at the equipment. "But, of course, it's not a radio, I know that much, did a bit of radio operating myself in Indonesia. Physics, very complicated stuff."

"Did anyone ever tell you that you talk too much, Jens?" Ove asked.

"Sometimes, but not twice." He closed a scarred fist that looked as big as a soccer ball. Then he laughed. "I talk a lot, but I don't say much. Only to friends." He picked up the equipment and started out. "It has been good speaking with you, gentlemen. Don't forget to call on old Jens when you need help." Then he was gone.

"An interesting personality," Arnie said. "Do you think he will tell anyone about this?"

"I hope not. And I doubt it. But I think I'll mention him to Skou, just in case."

"You've caught his security bug."

"Perhaps. But if everything goes according to plan tonight we are going to have something that we very much want to keep under wraps."

"The signal is fine now," Arnie said, and flipped off the power and leaned back and stretched. "That is all we can do for the moment. What comes next?"

Ove looked at his watch. "Six o'clock and I'm getting hungry. It was arranged for us to eat aboard."

"The captain will really enjoy having us. Boiled fish, boiled potatoes and alcohol-free beer, I suppose. We should take turns. Why don't you eat first, I am not very hungry."

"After your undoubtedly accurate description neither am I. But I'll volunteer since it was my idea. It will be eleven o'clock before anyone shows up so we have more than enough time."

Arnie puttered with the equipment and worked out an estimate on field strength at maximum output, so the time passed quickly. He unlocked the door when Ove called to him.

"Not one half as bad as we expected. Roast pork and red cabbage, very filling in a hearty, nautical way. Unless you have acquired some dietetic prejudices since I saw you last?"

"Hardly. Modern Judaism is more a state of mind and a cultural heritage than a religion. Though I admit that it is easier to find poultry than pork in Tel-Aviv. I look forward to the dinner."

Just before eleven the field telephone rang with a clanging military urgency. Ove answered it.

"Skou here. The observers are assembling and they wish to know when the demonstration will begin?"

"At once, tell them. Tell them I'm on my way up." He rang off and turned to Arnie. "Ready?"

"Ready as we will ever be, I imagine." He took a deep breath. "You had better stay on the other end of this phone so we can be in touch. Keep me informed constantly."

"You know I'll do that. And it's going to work, be sure of that."

"I *hope* that. We will look quite the fools if it does not."

"The laboratory results . . ."

"Are not a field trial. We are going to try that now. Let me know when I am to start."

Ove followed the telephone wire up through the ship and, when he opened the outer door, was pelted in the face by a flurry of fine snow. It was carried by a biting wind that made him close his coat tightly and turn up the collar. From the top of the gangway he could see the huddle of dark figures against the far wall of the quay. Skou was waiting for him when he came down.

"If you are ready, they would be pleased if you started. Admiral Sander-Lange there is in his seventies and we have two generals not much younger."

"The Prime Minister . . . ?"

"Decided at the last minute not to come. But there is his representative. The Air Force people are here, everyone on the list."

"We are all ready then. If you'll bring the phone over, I'll brief them and we can begin."

"I would like some explanation," the admiral said when Ove came up, more than an echo of command still in his old man's voice.

"I'll be happy to, sir. What we hope to do here is to demonstrate the Daleth effect . . ."

"Daleth?" a general asked.

"The fourth letter of the Hebrew alphabet. The symbol that Professor Klein had assigned to the factor in the equation that led to the discovery."

"What discovery?" someone asked, puzzled.

Ove smiled, his features barely visible in the snow-obscured light of the overhead lamp.

"That is what we are here to observe. The Daleth effect has been proven in theory, and in limited laboratory experiments. This is the first time that it has been attempted on a large enough scale to prove whether it will be universally applicable or not. Since there was so much physical difficulty, and security, in setting up this trial, it was decided that observers should be present even if there were a chance of failure."

"Failure of *what?*" an irritated voice asked.

"That will be obvious enough in a few minutes . . ." the telephone rang and Ove broke off. "Yes?"

"Are you ready to start?"

"Yes. Minimum power to begin with?"

"Minimum power. Beginning."

"If you gentlemen will watch the ship," Ove said, covering the mouthpiece.

There was very little to see. Flurries of fine snow swept through the cones of light along the quay. The *Isbjorn*'s gangplank had been raised, as had been instructed, and men stood by on the fore and aft cables which had been slacked off. The tide had carried the ship away from the guay so that a gap of dark water could be seen. Waves gurgled and slapped between the hull and the stone wall of the quay.

"Nothing yet," Ove said.

"I'm turning up the output."

The men were stamping their feet in the cold and there was an undertone of irritated murmuring. One of them turned to Ove, a complaint ready on his lips when a sudden, high-pitched whining filled the air. It seemed to come from all directions at once, sourceless and irritating, making them feel as though the bones in their skulls were vibrating. This painful aspect of the sound passed quickly, though the vibration itself remained, at a lower pitch, like the string on some celestial bass viol, humming to itself behind the backdrop of the world.

As this first sound died away, a creaking began in the *Isbjorn*, sounding first one part of the hull then the other. There were excited shouts on deck. Something like a shudder passed through the ship and tiny waves broke all around it and sucked at the hull.

"Look!" someone gasped. They looked. It was incredible.

As though mounted on a giant underwater piston, the entire mass of the bulky icebreaker was slowly rising in the water. First the Plimsoll line appeared, then the red-leaded bottom of her hull. Dim blots of barnacles spotted it here and there and then, farther down, hanks of weed trailed limply. At the stern the lower, barnacled part of the rudder appeared, as well as the propeller, rising steadily until all of its dripping blades were clear of the water. The seamen on shore quickly payed out line as the cables grew taut.

"What is happening? What is this?" one of the observers called out, but his voice was drowned out as others shouted with excitement.

The snow was lessening, blowing away in gaps and swirls: the lights on the quay now shone clearly on the ship and the sea. Water ran in continuous streams, louder than the slap of waves against the stone.

The keel of the ship was now a good meter above the surface of the Yderhavn channel.

"Arnie, that's it. You've done it!" Ove clutched the phone looking at the multi-thousand tonned mass of the ship before him that floated, unsupported, in the air. "It's a meter above the surface at least. Reduce power now, reduce . . ."

"I am," the voice was strained. *"But there is an harmonic building up, a standing wave . . ."*

His words were drowned in a groan of metal from the *Isbjorn* and the ship seemed to shudder. Then, with frightening suddenness, the stern dropped into the water as though some invisible support had been removed, sliding back and down.

The sound was the crash of a giant waterfall, a crescendo of noise. In an instant, rearing up like an attacking animal, a wave of black water surged high over the edge of the quay, hung poised, one meter, two meters above—then plunged. Changing instantly to a bubbling, knee-high foaming tide that tore at the observers and splashed high against the rear wall. It swept the men off their feet, jumbled them together, hurled them apart, left them stranded like beached fish as it drained away in a wide sheet of darkness.

As it subsided the groans and cries went up, and the shouts were echoed aboard the ship.

"Over here, it's the admiral!"

"Don't touch him—that leg's broken at least, maybe worse."

"Get off me. . . !"

"Someone call an ambulance, this man's hurt . . ."

Heavy boots hammered on the stone as the guards ran up: someone was shouting into a police radio. Aboard the *Isbjorn* there was the clang of metal as she wallowed back and forth, and her captain's

voice could be clearly heard above the others.

"Taking water aft—the wooden plugs, you fools. When I get my hands on the people who . . . !"

The ear-hurting *bahh-boo* of police cars grew louder, and in the distance there was the rapid clanging of ambulance bells. Headlights raced down the length of the quay as water ran from its edge in a hundred tiny waterfalls.

Ove was dazed, washed against the wall, soaked to the skin and tangled in the wire from the telephone. He pushed himself to a sitting position, back against the rough stone, looking at the frantic scene of shouting men with the *Isbjorn* still rocking in the background. He was shocked by the suddenness of the disaster, the wounded, possibly dead men near him. This was terrible, it should not have happened.

At the same time he was filled with such a rising feeling of exultation that he almost shouted aloud. It worked! They had done it! The Daleth effect was as Arnie had predicted it would be.

There was something new in the world, something that had never existed before this night, and from this moment onwards the world would never be the same again. He smiled into the darkness, unaware of the blood that was running down his chin, and of the fact that four of his front teeth had been knocked out.

Snow still drove past spasmodically, first dropping a sheet of obscurity and then lifting it for a tantalizing glimpse. The man on the other side of the channel of the Yderhavn cursed to himself in a continuous guttural monotone. This was the best he could do with such short notice and it was just not good enough.

He was on the roof of a warehouse, just across the half-mile wide channel from the Langelinie quay. This area was almost completely deserted after dark and he had had no trouble avoiding the few night watchmen and police who came by. His glasses were good, the very best Zeis-Ikon 200 mm. wide field, night glasses, but they could see nothing if nothing was there. The snow had started soon after the official cars had pulled up on the quay and had been drifting by ever since.

The cars were what had aroused his interest, the high-level activity so late at night, the concerted motion of a number of military people that he kept under observation. What it meant he had no idea. They had gone to that quay, in the dead of night in a snowstorm, to stand and look at a filthy scow of a coal-burning icebreaker. He cursed again and spat into the darkness, an ugly man, uglier now in his anger, with a tight mouth, round head, bullet neck, and thin gray hair cropped so short it might have been shaved.

What were these thick and stupid Danes up to? Something had happened, there had been an accident docking the ship perhaps, men had been knocked down. There had been a disturbance in the water. But there had been no sound of an explosion. Now there was plenty of excitement, ambulances and police cars coming from all sides. Whatever had happened had happened; there would be nothing else of importance to be seen here tonight. He cursed again as he rose, chilled, his knees stiff and cracking with the effort.

Something had happened, that was certain. And he was damned well going to find out what it was. That was what he was paid to do and that was what he enjoyed doing.

The ambulances clanged away, and it would have taken a keen eye in the darkness to see that the ice-breaker now rode lower in the water.

V

"Not much of a view," Bob Baxter admitted, "but it's one that I find inspiring in a way. It's kind of hard for me to forget my job when I look out of this window."

Baxter was a thin, gangling man, who seemed to fold at the joints like a carpenter's rule. His face was bland, instantly forgettable, and its most memorable feature was the thick, black-framed glasses that he wore. Without them you might not recognize him. Which was perhaps why he wore them. He slumped when he sat, deep in the swivel chair behind the desk, pointing out of the window with a freshly sharpened, yellow HB pencil stamped PROPERTY OF THE U.S. GOVERNMENT.

The only other man in the small office sat, bolt upright, on the front half of his chair, and nodded stiffly. This was not the first time he had heard about the view. He was a solid, ugly man, with tight-clamped lips and a very round head only partially covered with stubble of gray hair. The name he was known by was Horst Schmidt, which is just as much a hotel register name as is John Smith.

"Peaceful in a way," Baxter said, jabbing the point of the pencil at the white stones and green trees. "Nothing more peaceful than a graveyard I guess. And do you know what that building with the fancy roof is, right on the other side of the graveyard?"

"The embassy of the Union of Soviet Socialist Republics." His English was accented but good, with a marked tendency to roll the R's deep in the throat.

"Pretty symbolic that." Baxter swung about and dropped the pencil back onto his desk. "The American embassy being right across this graveyard from the Russian embassy. Gives you something to

think about. What have you found out about that trouble the other night down by the waterfront?"

"It has not been easy, Mr. Baxter. Everyone is being very close-mouthed." Schmidt reached into the inner pocket of his jacket and withdrew a folded sheet of paper, holding it at arm's length and squinting to read it. "This is the list of the people hospitalized with injuries, all of them admitted at roughly the same time. They are . . ."

"I'll make a Xerox of that list so you can skip the details. Can you just give me a summary now?"

"Of course. One admiral, one major general, one colonel, one other rank, one high-ranking member of the Ministry of State. Five individuals in all. I have good reason to believe that an unidentified number of other individuals were treated for bruises and dismissed. Among these numbered members of the Air Force."

"Very good. Most efficient."

"It was not easy. Military hospital records are hard to come by. There were expenses . . ."

"Just submit your gyp-sheet. You'll be paid, no fear. Now the sixty-four dollar question, if I may say so myself, is what *caused* all these injuries?"

"That is difficult to determine, you must realize. There is a ship involved, the *Isbjorn,* an icebreaker."

"That is not what I would call startling news since we have known it since the first day." Baxter frowned slightly and pushed the handful of sharpened pencils into a neat row on the unmarked green blotter before him. The only other item on the desk was a folding, leather-type plastic frame containing the picture of a round-faced smiling woman holding two equally moon-faced children. "There must be more."

"There is, sir. The *Isbjorn* has been towed across to the Naval shipyard in Christianshavn where it is being repaired. It appears to have suffered some sort of hull damage, possibly through collision. I have been able to determine that whatever is responsible for the damage to the ship, also injured the men. Getting this bit of information alone has been immensely difficult because of the security curtain that has been clamped down on the entire affair. This is enough to lead me to believe that something very important is going on."

"I believe the same thing, Horst, the same thing. This appears to be a big thing for the Danes, all the military involved, their State Department, even a damned icebreaker. And that icebreaker makes me think of ice and ice makes me think of Russia and I would like to know just what the hell is going on."

"You haven't then . . ." Horst smiled a completely unhumorous

grin that revealed a badly matched collection of yellow teeth, steel teeth, even the unexpected luxury of a gold tooth. "That is, I mean, there should be some information through NATO, should there not?"

"Which is none of your damn business whether there is or not. You are here to supply information to me, not the other way around. Though you might as well know that officially nothing has ever happened and no one is going to say one damned word to us about it." Under the cover of the desk he wiped his damp fingertips on his pants leg.

"That is very disloyal of them," Horst said with complete lack of emotion. "After all that your country has done for them."

"You can say that again." Baxter glanced quickly at his wrist watch. It was gold and contained an extraordinary number of hands and buttons. "You can give me a report in a week. Same day, same time. You should be able to find out something more by then."

Schmidt passed over the piece of paper with the names. "You said that you wished to photocopy this. And then there is the matter of . . ." He had his hand out, palm up, and he smiled quickly before lowering it.

"Money. Come right out and say it, Horst. Money. Nothing to be ashamed of. We all work for money; that's what keeps the wheels turning. I'll be right back."

Baxter took the paper and went through the connecting door to the next office. Schmidt sat, unmoving, while he waited, showing no interest in the desk or the filing cabinet against the wall. He yawned once, widely, then belched, smacking his lips afterwards with a dissatisfied expression. He took two white tablets from a plastic box in his pocket and chewed on them. Baxter returned and gave him back the sheet of paper and a long, unmarked envelope. Schmidt slipped them both into his pocket.

"Aren't you going to count it?" asked Baxter.

"You are a man of honor." He stood up, every inch the middle-class, middle-European in his wide-lapeled dark blue suit, heavy black shoes, wide-cut trousers with cuffs big enough to swallow his feet. Baxter's eyebrows raised up, above the black frames of his glasses, but he said nothing.

Schmidt took his coat and scarf from the stand in the corner, both as dark and coarse of texture as the wide-brimmed hat. He left without another word, using the door that opened into the gray and featureless hall. There was no nameplate on the outside of the door, just the number 117. Instead of turning into the lobby he continued along the hallway, then down a flight of stairs to the United States Information Service Library. There, without looking at the titles, he took two books from

the shelf nearest the door. While they were being checked out he shrugged into his coat. When he emerged into Østerbrogade a few minutes later he walked close behind another man who was also carrying books. The other turned right but he turned left, and walked stolidly past Garnisons churchyard and on to the Østerport subway station.

Inside the station he made use of almost all of the facilities, one after another. He bought a newspaper at the kiosk by the entrance, turning about and looking over the top of it to see who came in after him. He went to the toilet at the far end. He checked the books and the newspaper into an automat locker and pocketed the key. He went down one staircase to the trains and, although it was against the law to cross the tracks, managed to come up some time later by way of a different staircase. This appeared to be thirsty work and he finally had a glass of draught Carlsberg from the luncheonette, standing up and drinking it at one of the chest-high tables. All of these actions appeared to have accomplished what they had been designed to do because, after wiping the foam from his lips with the back of his hand, he emerged from the rear entrance of the station and walked briskly down Østbanegade, next to the tracks where they emerged from the tunnel into the watery winter sunshine. At the first corner he turned left and walked down along the other side of the churchyard. He was alone in the street.

When he was positive of this he turned about smartly and walked through the open, high wrought iron gates and into the Soviet Embassy.

VI

"Ja, Ja," Nils Hansen said into the telephone, *"jeg skal nok tale med hende. Tak for det."* He sat, tapping his fingers against the phone while he waited. The man who had identified himself only as Skou stood looking out of the window at the gray, wintry afternoon. There was the distant banshee scream of jets as one of the big planes taxied in from the runway.

"Hello, Martha," Nils continued in English. "How is everything? Fine. No, I'm at Kastrup, just set down a little while ago. A nice tail wind out of Athens, brought us in early. And that's the trouble, I'm going right out again . . ." He nodded agreement with the voice that rustled in his ear, looking more than a little unhappy.

"Listen, darling, you are completely correct and I couldn't agree more—but there is absolutely nothing we can do about it. The powers that be have willed otherwise. I can't fly, too many hours, but they can fly me. One of the pilots—a Swede, what else?—is

down with appendicitis in Calcutta. I'm going out on the next flight, in fact they are holding it for me right now, and I'll sleep and get another night's sleep at the Oberoi Grand, so I'll be able to take his flight out tomorrow. Right . . . Nearer forty-eight hours I would say. I am as sorry to miss the dinner as you are and please tell the Overgaards that I am crying because I shall miss her *dyresteg* and instead of fine Scandinavian venison I shall be eating gut-rotting curries and will suffer for a week. Of course, *skat*, I'll miss you, too, and I'll make them pay me a bonus and I'll buy you something nice with it. Yes . . . O K. . . . good-bye."

Nils hung up and looked with open dislike at Skou's turned back. "I don't enjoy lying to my wife," he said.

"I'm very sorry, Captain Hansen, but it cannot be avoided. A matter of security you know. Take precautions today and tomorrow takes care of itself." He looked at his watch. "The Calcutta plane is just leaving, and you are listed as being aboard. You are registered at the Calcutta hotel, though you will not be able to receive phone calls. Everything has been arranged with the utmost detail. The ruse is necessary but harmless."

"Necessary for *what?* You appear out of nowhere, take me to this office, show me letters with big names on them requesting my service, including one from my commander in the Air Force Reserve, extract my promise to cooperate, induce me to lie to my wife—but really tell me nothing. What the devil is going on?"

Skou nodded seriously, looked around the room as if it were lined with countless eavesdropping bugs, and did everything but put his finger to his lips: he radiated secrecy.

"If I could tell you, I would. I cannot. Within a very short time you will know all about it. Now—can we leave? I'll take your bag."

Nils grabbed it up before the other could touch it and stood, jamming his uniform cap onto his head. He was six feet four inches tall in stockinged feet: now, in uniform, cap and belted raincoat, he loomed large enough to fill the small room. Skou opened the door and Nils stamped out after him. They exited through the back door of the operations building where a cab was waiting for them, a Mercedes diesel hammering and throbbing while its engine idled. As soon as they had entered the driver put down his flag and started, without instructions. When they left the airport they turned right, away from Kastrup.

"That's interesting," Nils said, looking out of the window, the scowl now vanished from his face. He could never stay angry very long. "Instead of going to København, and the exciting world beyond, we head south on this little

pool table of a potato-growing island. What can we possibly find of interest in this direction?"

Skou reached over into the front seat and took up a black topcoat and a dark beret. "Would you be so kind as to take off your uniform coat and cap and put these on. I am sure that your trousers will not be identified with a SAS uniform."

"Cloak and dagger, by God," Nils said, struggling out of his coat in the cramped back seat. "I suppose this good and honest cab driver is in on the whole thing?"

"Of course."

The capacious front seat now yielded up a small suitcase just large enough for the discarded coat and cap. Nils pulled the collar of his new coat up, pulled the beret down over his eyes and buried his big chin in the collar.

"There, do I look conspiratorial enough now?" He could not stop himself from grinning. Skou did not share his humor.

"I'll ask you, please, not to do anything that will draw attention to us. This is a very important matter, I can tell you that much."

"I'm sure of it."

They rode in silence after that, through a drab landscape of freshly plowed fields waiting for the spring sowing. It was a short drive to the fishing village of Dragør, and Nils looked suspiciously at the old, red brick buildings as they passed. They did not stop, but continued on to the harbor.

"Sweden?" Nils asked. "Aboard the car ferry?"

Skou did not trouble himself to answer and they drove right by the ferry slip to the small harbor. A few pleasure craft were tied up here, including a fair sized inboard launch.

"If you will follow me, please," Skou said, and grabbed Nils' bag before he could get it himself. He led the way out on the dock, carrying both bags. Nils followed meekly after, wondering just what he was getting into. Skou climbed aboard the launch and put the bags into the cabin, then waved Nils aboard. The man at the wheel appeared to ignore all this, but he did start the engine.

"I'll say good-bye then," Skou said. "I think it will be most comfortable traveling in the cabin."

"Traveling where?"

Skou left without answering and began to untie the mooring lines. Nils shrugged, then bent over to get through the low cabin door. He dropped onto the bench inside and discovered, tardily, because of the dim light that filtered through the small portholes, that he was not alone.

"Good afternoon," he said to the muffled figure on the far end of the other bench, and received a noncommittal answer in return. As his eyes adjusted to the light he realized that there was a suitcase at the other man's feet and that he

was wearing a black coat and dark beret.

"How about that," Nils laughed. "Looks like they caught you, too. We're wearing the same uniform."

"I don't know what you are talking about," the other said, testily, pulling off the beret and jamming it into his pocket. Nils moved along the bench to sit opposite him.

"Oh, yes, you do. That Skou with his mysterious ways. Very little imagination though when it comes to disguise. I'll bet you were drafted for a secret job in a big hurry and rushed over here."

"How do you know that?" the other asked, sitting up.

"Instinct." Nils pulled off his beret and pointed to it—then looked closer at the other man's face. "Don't I know you from somewhere? A party or something . . . no, from the magazine. You're the submarine fellow who helped salvage that 707 off the coast. Carlsson, Henriksen or something like . . ."

"Henning Wilhelmsen."

"Nils Hansen."

They shook hands automatically after this exchange of names, and the air of tension lessened. It was warm in the tiny cabin and Nils opened his coat. The motor chugged steadily as they pulled away from shore. Wilhelmsen looked at the other's uniform.

"Now isn't that interesting," he said. "A naval commander and a SAS pilot wallowing out into the Øresund aboard a scow. What could this possibly mean?"

"Maybe Denmark has an aircraft carrier we don't know about?"

"Then why me? It would have to be a submarine aircraft carrier and *that* I would have heard something about. How about a drink?"

"The bar isn't open."

"It is now." Wilhelmsen pulled a leather covered flask from his side pocket. "The motto of the submarine service is 'be prepared'."

Nils smacked his lips unconsciously as dark liquid was poured into the metal cup. "I can't if I'm going to fly in the next twelve hours."

"Little chance of that out here, unless this barge sprouts wings. Besides, this is navy rum, alcohol free."

"I accept your offer."

The rum tasted quite good and put a better temper to the afternoon. After a certain amount of circling around the topic they exchanged information, only to discover this merely doubled their lack of knowledge. They were going somewhere for reasons unknown. After squinting at the setting sun they agreed that the only bit of Danish landscape that lay in this direction was the island of Bornholm, which was an impossibility in their light craft. Half an hour later their question was answered when the launch's engine was cut and the portholes on the

starboard side suddenly darkened.

"A ship, of course," Henning Wilhelmsen said, and poked his head out of the door. "The *MS Vitus Bering*."

"Never heard of her."

"I certainly have. It's a Marine Institute ship. I was aboard her last year when she was mother ship for *Blæksprutten*, the small experimental sub. I did the trial runs."

Feet thudded to the deck and a sailor poked his head in and asked for their baggage. They passed it out, then followed him up the heaving ladder. A ship's officer invited them to the wardroom, then showed them the way. There were more than a dozen uniformed men waiting there, representatives of all the armed forces, as well as four civilians. Nils recognized two of them, a politician he had once had as a passenger, and Professor Rasmussen, the Nobel prize winner.

"If you will sit down, gentlemen," Ove Rasmussen said, "I'll tell you why we are all here."

By dawn the next morning they were far out in the Baltic, in international waters, a hundred miles from land. Arnie had slept badly, he wasn't much of a sailor and the pitching of the ship had kept him awake. He was the last one on deck and he joined the others as they watched *Blæksprutten* being swung up out of the hold.

"Looks like a toy," Nils Hansen said. The big pilot, although he wore his SAS cap was, like all of the others, now dressed in high rubber boots, sweater, and heavy wool pants to stop the cutting arctic wind. It was a lowering winter day with the clouds pressing down and the horizon close by.

"She's no toy—and she's bigger than she looks," Wilhelmsen defended warmly. "With a crew of three she can still carry a couple of observers. Dives well, good control, plenty of depth . . ."

"No propellers though," Nils said gloomily, winking at the others. "They must have got broken off . . ."

"This is a sub, not one of your flying machines! It has water impellers, jets, just like those stupid great things of yours. That's why it's called *Blæksprutten*—it moves by jetting water just like a squid."

Arnie caught Ove's eye and motioned him aside.

"A perfect day for the trials," Ove said, pushing at his new front teeth with his tongue; they still felt strange. "The visibility is down and nothing at all on the radar. An Air Force plane overflew us earlier and reported the nearest ship to be over one hundred forty kilometers distant. Just a Polish coastal freighter at that."

"I would like to be aboard for the tests, Ove."

Ove took him lightly by the shoulder. "Don't think I don't know that. I don't want to take

your place. But the Minister thinks that you are too valuable a man to be risked this first time out. And I guess that he is right. But I would still change if I could—only they won't let me. The admiral knows the order and he'll see that it is obeyed. Don't worry—I'll take good care of your baby. We've eliminated that harmonic trouble and there's nothing else that can go wrong. You'll see."

Arnie shrugged with submission, knowing that further argument would be useless.

With much waving and shouted instructions the small sub was swung out and lowered into the sea. Henning Wilhelmsen was down the ladder almost before it touched, leaping aboard. He vanished down the hatch on top of the conning tower and, a few minutes later, there was an underwater rumbling as her engines started. Henning popped up through the hatch and waved. "Come aboard," he called.

Ove took Arnie's hand. "It's going to be all right," he said. "Since we installed the Daleth unit we have checked it over a dozen different times."

"I know, Ove. Good luck."

Ove climbed down the ladder with Nils Hansen right behind him. They entered and closed the hatch.

"Cast off," Henning said, his voice booming from the loudspeaker that, connected to the short-range, low-powered radio, had been installed on deck. The lines were pulled free and the little sub turned and began to move away. Arnie took up the microphone and pressed to talk.

"Take it out about three hundred meters before beginning the test."

"Ja vel!"

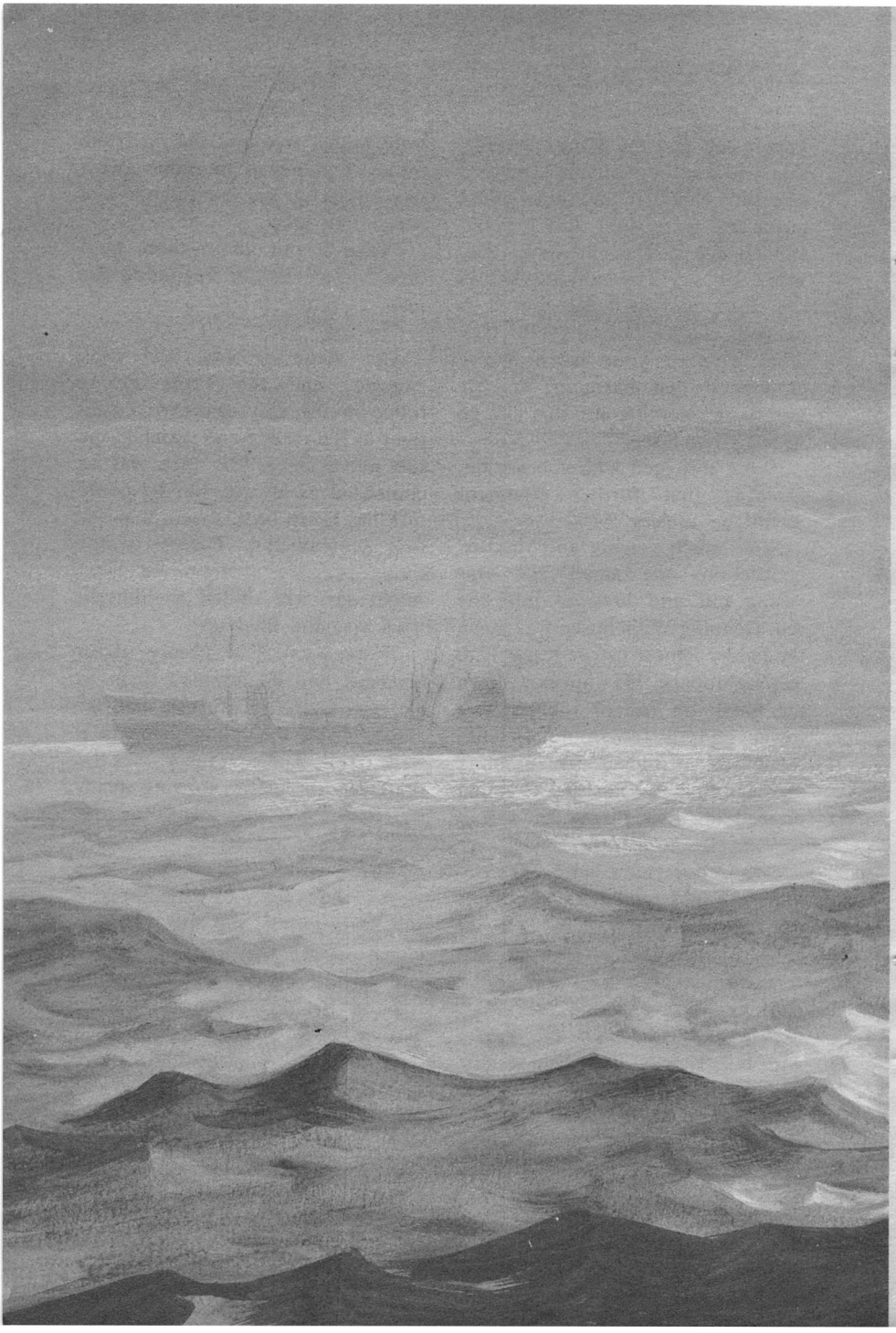
The ship's engines had been stopped, and the *Vitus Bering* rolled in the easy sea. Arnie held tight to the railing and watched the sub move away. His face was as composed as always, but he could feel his heart beat, faster than he ever remembered. Theory is one thing, practice another. As Skou might say. He smiled to himself. This was the final test.

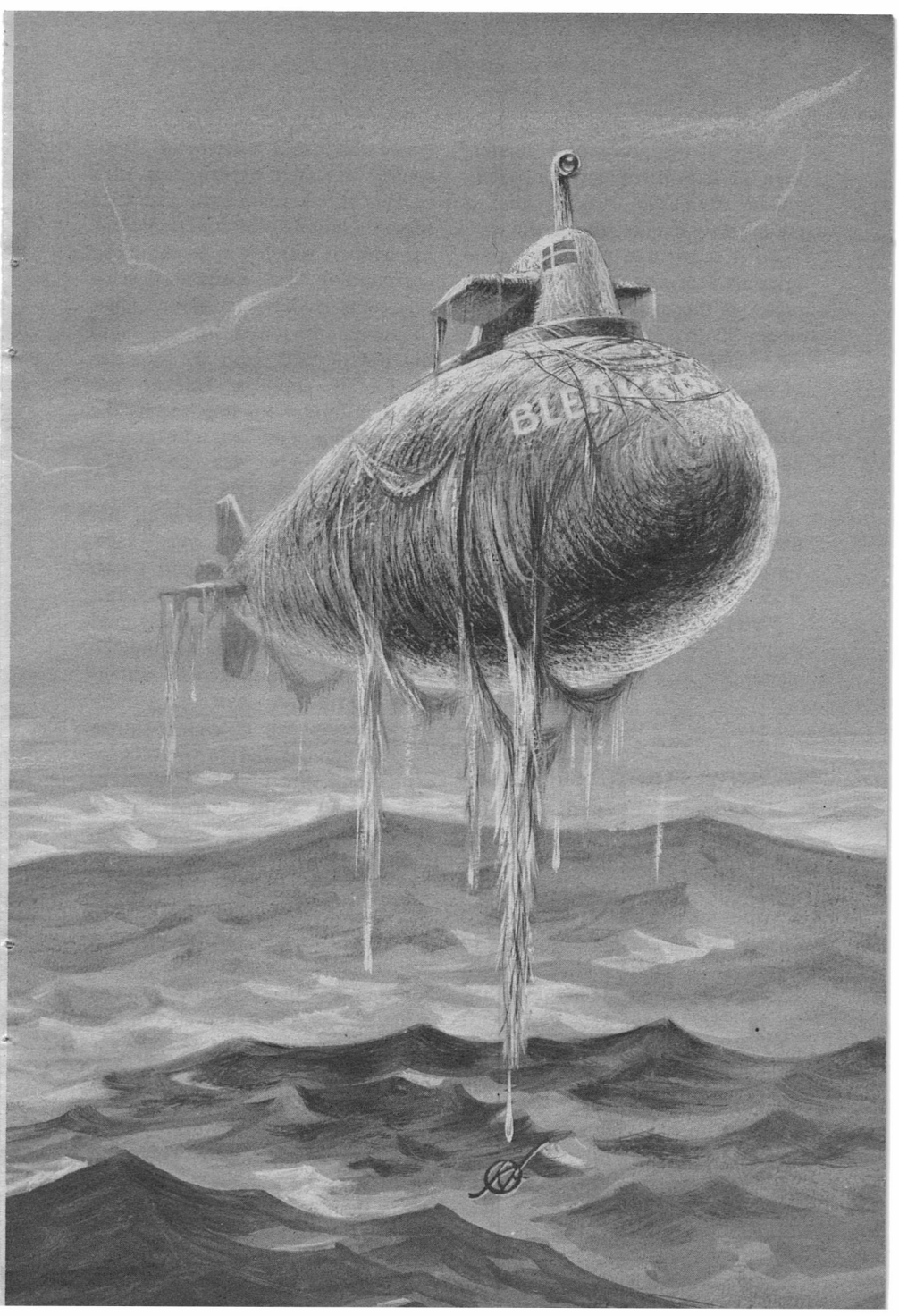
There were field glasses about his neck and he fumbled them to his eyes as the sub turned and began to circle the mother ship in a wide circle. Through the glasses the craft was very clear, moving steadily, its hull barely awash as the waves broke against it.

Then—yes, it was true—the waves were splashing against the side and more of the hull was visible. It appeared to be rising higher and higher in the water floating unnaturally high—then rising even farther.

Until, like a great balloon, it rested on the surface.

Rose above the surface. Went up gracefully five, ten, thirty meters. Arnie dropped the glasses on their strap and held the rail tightly, looking, frozen.





With all the grace of a lighter-than-air craft the twenty-ton, thick-hulled submarine was floating a good forty meters above the sea. Then it seemed to rotate on some invisible bearing until it pointed directly at the mother ship. Moving slowly it drifted their way, sliding over their upturned faces, a spray of fine droplets falling from its still dripping hull. No one spoke—struck speechless by the almost unbelievable sight—and the stuttering of the submarine's diesel engines could be clearly heard. Without turning his eyes away, Arnie groped for the microphone and switched it on.

"You can bring it in now. I think that we can call the experiment a success."

VII

With the blackboard behind him and the circle of seated, eager listeners before him, Arnie felt very much at home. As though he were back in a classroom at the university, not the wardroom of the *Vitus Bering*. He resisted the impulse to turn and write his name, ARNIE KLEIN, in large letters upon the board. But he did write DALETH EFFECT very clearly at the top, then the Hebrew letter, ד, after it.

"If you will be patient for a moment, I must give you a small amount of history in order to explain what you witnessed this morning. You will remember that Israel conducted a series of atmospheric research experiments with rockets a few years ago. The tests served a number of functions, not the least of which was to show the surrounding Arab countries that we . . . that is they, Israel . . . had home-manufactured rockets and did not depend upon the vagaries of foreign supplies. Due to the physical limitations imposed by the surrounding countries, and the size of Israel, there was very little choice of trajectories. Straight up and straight back down was all that we could do, and some very exacting control techniques had to be worked out to accomplish this. But a rocket that rose vertically and stayed directly above the launch site on the ground proved an invaluable research device for a number of disciplines. A trailing smoke cloud supplied the meteorologists with wind direction and speed at all altitudes, while internal instrumentation recordings later coordinated this with atmospheric pressure and temperature. Once out of the atmosphere there were even more experiments, but the one that we concern ourselves with now is the one that inadvertently revealed what can only be called gravimetric anomalies." He started to write the word on the blackboard but controlled himself at the last moment.

"My interest at the time was in quasars, and the possible source of their incomprehensible energies. Even the total annihilation of mat-

ter, as you know, cannot explain the energy generation of quasars. But this became almost incidental because—completely by chance—this rocket probe was out of the atmosphere when a solar flare started. It was there for almost fifty minutes. Other probes, in the past, have been launched as soon as a flare has been detected, but this means a lag of an hour at least after the original explosion of energy. Therefore I had the first readings to work with on the complete buildup of a solar flare. Magnetometer, cosmic ray particles—and something that looked completely irrelevant at the time—the engineering data. This drew my attention because I had been working for some years on certain aspects of the Einsteinian quantum theory that relate to gravity. This research had just proven to be a complete dead end, but it was still on my mind. So when the others discarded some of the data because they believed the telemetry was misreading due to the strong magnetic fields, I investigated in greater detail. The report was actually sound, but it showed that a wholly inexplicable force operating that seemingly reduced the probe's weight, but not its mass. That is to say that its gravitational mass and inertial mass were temporarily unequal. I assigned the symbol *Daleth* to this discrepancy factor and then sought to find out what it was. To begin with, I at once thought of the Schwarzchild mass, or rather the application of this to the four-dimensional continuum of the Minkowski universe . . ."

The baffled expression on all the faces finally drew Arnie's attention —including one high-ranking officer whose eyes were glazed, almost bulging—and he slowed and stopped. He coughed into his fist to cover his confusion. These were not physics students after all. Turning to the board he added another underscore to the *Daleth*.

"Not to go into too many details, I will attempt to explain this observation in simple language. Though you must understand that this is an approximation only of what occurred. I had something that I could not explain, though it was something that was obviously there. Like taking a dozen chicken eggs and hatching them and having an eagle come out of one. It is there, clearly enough, but why and how we do not know."

A relieved chuckle moved across the wardroom and there were even a few smiles as they finally found themselves understanding something that was being said. Encouraged, Arnie stayed on common ground.

"I began to work with the anomaly, first setting up mathematical models to determine its nature, then some simple experiments. In physics, as in all things, knowing just what you are looking for can

be a great aid. For example, it is easier to find a criminal in a city if you have a description, or a name. Once helium had been detected in the spectrum of the sun its presence was uncovered here on Earth. It had been here all the time, unnoticed until we knew what to look for.

"The same is true of the Daleth effect. I knew what to look for and I found answers to my questions. I speculated that it might be possible to control this . . ." he groped for a word. "It is not true, and I should not do it, but for the moment let us call it an 'energy'. Remembering all the time that it is not an energy. I set up an experi nent in an attempt to control this energy which had rather spectacular results. Control was possible. Once tapped the Daleth energy could be modulated; this was little more than an application of current technology. You saw the results this morning when *Blæksprutten* rose into the air. This was a very limited demonstration. There is no reason why the submarine could not have traveled above the atmosphere at speeds of our own choosing."

A hand was raised, with positive assurance, and Arnie nodded in that direction. At least someone was listening closely enough to want to ask a question. It was an Air Force officer, looking young for the high rank that he held.

"You'll pardon my saying this, Professor Klein, but aren't you getting something for nothing? Which I have been taught is impossible. You are negating the Newtonian laws of motion. There is not enough power in the sub's engines, no matter how applied, other than by a block and tackle, to lift its mass and hold it suspended. You mentioned Relativity, which is based solidly on the conservation of momentum, mass energy, and electric charge. What appears to have happened here must throw at least two out of the three into doubt."

"Very true," Arnie agreed. "But we are not ignoring these restrictions, we are simply using a different frame of reference in which they do not apply. As an analogy I ask you to consider the act of turning a valve. A few foot pounds will open a valve that will allow compressed gas to leave a tank and expand into a bag and cause a balloon to rise. An even better comparison might be to think of yourself as hanging by a cord from that bag, high above the Earth. An ounce or so of pressure on a sharp blade will cut the cord and bring you back to the ground with highly dramatic effects."

"But cutting the cord just releases the kinetic energy stored by lifting me to that height," the officer said warmly. "It is the gravity of the Earth that brings me down."

"Precisely. And it was the released gravity of the Earth that permitted *Blæksprutten* to fly."

"But that is impossible!"

"Impossible or not it happened," an even higher ranking Air Force officer called. "You damned well better believe your own eyes, Preben, or I'll have you grounded."

The officer sat down, scowling at the general laughter, which died away as Admiral Sander-Lange began to speak.

"I believe everything you say about the theory of your machine, Professor Klein, and I thank you for attempting to explain it to us. But I hope you will not be insulted when I say that, at least for me, it is not of the utmost importance. Many years back I stopped trying to understand all the boxes-of-tricks they were putting on my ships and set myself the task of only understanding what they did and how they could be used. Could you explain the possibilities, the things that might be accomplished by application of your Daleth effect?"

"Yes, of course. But I hope that you will understand that there are still a number of 'ifs' attached. If the effect can be applied as we hope—and the next experiment with *Blæksprutten* will determine that—and if the energy demands are within reason to obtain the desired results, then we will have what might be called a true space drive."

"What exactly do you mean by that?" Sander-Lange asked.

"First consider the space drive we now use, reaction rockets such as the ones that power the Soviet capsule that is now on its way to the Moon. Rockets move through application of the law of action-and-reaction. Throw something away in one direction and you move in the other. Thousands of pounds of fuel, reaction mass, must be lifted for every pound that arrives at its destination. This process is expensive, complicated, and of only limited usage. A true space drive, independent of this mass-to-load ratio would be as functionally practical as an automobile or a seagoing ship. It would power a true spacegoing ship. The planets might become as accessible as the other parts of our own world. Since reaction mass is not to be considered, a true space drive could be run constantly, building up acceleration to midpoint in its flight, then reversing direction and decelerating continuously until it landed. This would make a simply incredible difference in the time needed to fly to the Moon or the planets."

"How big a difference?" someone asked. "Could you give us some specific figures?"

Arnie hesitated, thinking, but Ove Rasmussen stood to answer. "I think I can give you some help. I have been working it out while we have been talking." He lifted his slide rule and made a few rapid calculations. "If we have a continuous acceleration and deceleration of one G, one Gravity; there

will be no feeling of either free fall or excess weight to passengers in the vehicle. This will be an acceleration of . . . 980, we'll call it 1,000 for simplicity, centimeters per second per second. The Moon is, on the average, about 400,000 kilometers distant. The result therefore would be . . ."

There was complete silence as he made the calculations. He read off the result, frowned, then did it over again. The answer appeared to be the same, because he looked up and smiled.

"If the Daleth effect does produce a true space drive, there is something new under the sun, gentlemen.

"We will be able to fly from here to the Moon in a little under four hours."

During the unbelieving silence that followed he made another calculation.

"The voyage to Mars will take a bit longer. After all, the red planet is over 80 million kilometers distant at its closest conjunction. But even that voyage will be made in about thirty-nine hours. A day and three quarters. Not too long."

They were stunned. But as they thought of the possibilities opened up by the Daleth effect a babble of conversation rose, so loud that Arnie had to tap on the blackboard with his chalk to get their attention and to silence them. They listened now with a fierce attention.

"As you see, the possibilities of the exploitation of the Daleth drive are almost incalculable. We must change all of our attitudes about the size of the solar system. But before we sail off to the Moon for a weekend of exploration we must be sure that we have an adequate source of motive power. Will the drive work away from the Earth's surface? Is it precisely controllable —that is, can we make the minute course adjustments needed to reach an object of astronomical distances? Do we have a power source great enough to supply the energy demands for the voyage? Is the drive continuously reliable?

"The next flight of *Blæksprutten* should answer most of these questions. The craft will attempt to rise to the top of the Earth's atmosphere.

"As the most qualified person in regards to the drive equipment, I shall personally conduct the tests." He looked around, jaw clamped, as though expecting to be differed with, but there was only silence. This was his day.

"Thank you. I would suggest then that the second trial be begun immediately."

VIII

"I'm beginning to see why they might need an airline pilot aboard a submarine," Nils said, spinning the wheel that sealed the lower hatch in the conning tower.

"Keep the log, will you?" Henning asked, pointing to the open book on the little navigator's table fixed to the bulkhead.

"I'll do just that," Nils said, looking at his watch and making an entry. "If this thing works, you'll be the only sub commander ever to get flight pay."

"Take us out please, will you, Commander Wilhelmsen?" Arnie said, intent upon his instruments. "At least as far as you did the first time."

"Ja vel." Henning advanced the impeller one notch and the pumps throbbed beneath their feet. He sat in the pilot's seat just ahead of the conning tower. The hull rose here in a protuberance that contained three round, immensely thick ports. A control wheel, very much like that in an airplane, determined direction. For turning left and right it varied the relative speed of the twin water jets that propelled the sub. Tail planes aft caused them to rise or fall.

"Two hundred meters out," Henning announced, and eased off on the power.

"The pumps for your jets, are they mechanical?" Arnie asked.

"Yes, electrically driven."

"Can you cut them off completely and still maintain a constant output from your generator? We have voltage regulators, but it would help if you could produce as constant a supply as is possible."

Henning threw a series of switches. "All motor power off. There is still an instrumentation drain as well as the atmosphere equipment. I can cut them off—for a limited time—if you like."

"No, this will be fine. I am now activating the drive unit and will rise under minimum power to a height of approximately one hundred meters."

Nils made an entry in the log and looked at the waves splashing at the porthole nearest him. "You don't happen to have an altimeter fitted aboard this tub, do you, Henning?"

"Not really."

"Pity. Have to get one installed. And radar instead of that sonar. I have a feeling that you're getting out of your depth . . ."

Henning had a pained look and shook his head dolefully—then glanced at the port as a vibration, more felt than heard, swept through the sub. The surface of the water was dropping at a steady rate.

"Airborne now," he said, and looked helplessly at his useless instruments. The ascent continued; moments passed.

"One hundred meters," Nils said, estimating their height above the ship below. Arnie made a slight adjustment and turned to face them.

"There appears to be more than enough power in reserve even while the drive is holding the mass of this submarine at this altitude. The equipment is functioning well and

is in no danger of overloading. Are you gentlemen ready?"

"I'm never going to be more ready."

"Push the button or whatever, Professor. Just hanging here seems to be doing me no good."

The humming increased and their chairs pressed up against them. Nils and Henning stared through the ports, struck silent by emotion, as the tiny submarine leaped towards the sky. A thin whistle vibrated through the hull as the air rushed past outside, scarcely louder than the sigh of the air-conditioning unit. The engine throbbed steadily. Seemingly without effort, as silently as a film taken from an ascending rocket, their strange craft was hurling itself into the sky. The sea below seemed to smooth out, their mother ship shrinking to the size of a model, then to a bathtub toy, before the low-lying clouds closed in around them.

"This is worse than flying blind," Nils said, his great hands clenching and unclenching. "Seat of the pants, not a single instrument other than a compass, it's just not right."

Arnie was the calmest of the three, too attentive to his instruments to even take a quick glimpse through one of the ports. "The next flight will have all the instrumentation," he said. "This is a trial. Just up and down like an elevator. Meanwhile the Daleth unit shows that we are still vertical in relation to the Earth's gravity, still moving away from it at the same speed."

The cloud layers were thick, but soon fell away beneath their keel. Then the steady rhythm of the diesel engines changed just as Arnie said, "The current—it is dropping! What is wrong?"

Henning was in the tiny engine compartment, shouting out at them.

"Something, the fuel, I don't know, they're losing power . . ."

"The atmospheric pressure," Nils said. "We've reached our ceiling. The oxygen content of the air is way down—"

The engine coughed, stuttered, almost died, and a shudder went through the submarine. An instant later they started to fall.

"Can't you do something?" Arnie called out, working desperately at the controls. "The flow—so erratic—the Daleth effect is becoming inoperable. Can't you stabilize the current?"

"The batteries!" Henning dived for his position as he spoke, almost floating in the air, so quickly was their fall accelerating.

He clutched at the back of his chair, missed, floated up and hit painfully against the periscope housing and bounced back. This time his fingers caught the chair and he pulled himself down into it and strapped in. He reached for the switches.

"Current on—full!"

The fall continued. Arnie glanced quickly at the other two men.

"Get ready. I have cut the drive completely. When I engage it now I am afraid that the reaction will not be gentle because . . ."

Metal screeched, equipment crashed and broke, and there were hoarse gasps as the sudden deceleration drove the air from their lungs. They were slammed down hard into their chairs, painfully, and for an instant they hovered at the edge of blackout as the blood drained from their brains.

Then it was over and they were gasping for air, dizzily. Henning's face was a white mask streaked with red, bleeding from an unnoticed scalp wound where his skull had struck the periscope. Outside there were only clouds. The engine ran smoothly and the air hushed from the vents, soft background to their rough breathing.

"Let us not," Nils said, taking a deep breath "do *that* again!"

"We are maintaining altitude with no lateral motion," Arnie said, his words calm despite the hardness of his breathing. "Do you wish to return—or to complete the test?"

"As long as this doesn't happen again, I'm for going on," Nils said.

"Agreed. But I suggest that we operate on the batteries."

"How is the charge?"

"Excellent. Down less than five percent."

"We will go back up. Let me know when the charge is down to seventy percent and we will return. That should give us an acceptable safety margin. Plus the fact that engines can be restarted when we are low enough."

It was smooth, exhilarating. The clouds dropped below them and the engine labored. Henning shut it down and sealed the air intake. They rose.

"Five thousand meters high at least," Nils said, squinting at the cloud cover below with a pilot's eye. "Most of the atmosphere is below us now."

"Then I can step up the acceleration. Please note the time."

"It's all in the log. Some of it in a very shaky handwriting."

The curvature of the Earth was visible, the atmosphere a blue band above it tapering into the black of space. The brighter stars could be seen; the sun burned like a beacon and, shining through the port, threw a patch of eye-hurting brightness onto the deck. The upwards pressure ceased.

"Here we are," Arnie said. "The equipment is functioning well, we are holding our position. Can anyone estimate our altitude?"

"One hundred fifty kilometers," Nils said. "Ninety or a hundred miles. It looks very much like the pictures shot from the satellites at that altitude."

"Battery reserve seventy-five percent and dropping slowly."

"Yes, it takes power to hover, scarcely less than acceleration."

"Then we've done it!" Nils said and, even louder when the enormity struck him, "We've done it! We can go anywhere—do anything. We've really done it . . ."

"Battery reserve nearing seventy percent."

"We will go down then."

"A little slower than last time?"

"You can be sure of that."

More gently than a falling leaf, the submarine dropped. They passed through a silvery layer of high cirrus clouds.

"Won't we be coming down much farther to the west?" Nils asked. "The Earth will have rotated out from under us so we won't be able to set down in the same spot."

"No, I have compensated for that motion. We should be no more than a mile or two from the original position."

"Then I had better get on the radio." Henning switched it on. "We'll be in range soon and we'll want to tell them . . ."

A voice came clearly through the background static, speaking the fast, slang-filled Copenhagen Danish that only a native of that city would be able to understand.

". . . *Dive, daughter dive, and don't come up for air. Swim deep little sister, swim deep . . .*"

"What on earth are they talking about?" Arnie asked.

"That!" Nils said, looking out the port and turning his head swiftly to follow the silver, swept-wing forms that flashed by below. "Russian MIG. We're just out of the clouds and I don't think they saw us. Can we drop any faster?"

"Hold on."

A twist of Arnie's fingers pushed their stomachs up into their throats.

"Let me know when we are about two hundred meters above the water," he said calmly. "So I can slow the drop before we hit."

Nils clutched the arms of his chair to keep from floating up despite his belt. The leaden surface of the Baltic flashed towards them, closer and closer, the waves with white caps were visible and the *Vitus Bering* off to one side.

"Closer . . . closer . . . NOW!"

They were slammed down, loose equipment rolled, sliding across the suddenly canted deck. Then an even more powerful force crashed into the sub, jarring the entire hull, as they plunged beneath the surface.

"Will you please take over, Commander Wilhelmsen?" Arnie said, and for the first time his voice was a bit uneven. "I am shutting down the Daleth unit."

The pumps throbbed to life and Henning almost caressed his control panel. It was hard to fly as a passenger in one's own submarine. He whistled between his teeth as he made a slow turn and angled up to periscope depth.

"Take a look through the periscope, will you, Hansen? It's easy enough to use, just like they do in the movies."

"Up periscope!" Nils chanted, slapping the handles down and twisting his cap backwards. He ground his face into the rubber cushion. "I can't see blast-all."

"Turn the knob to focus the lenses."

"Yes, that's better. The ship's off to port about thirty degrees." He swept the periscope in a circle. "No other ships in sight. This thing doesn't have a big enough field, so I can't tell about the sky."

"We'll have to take a chance. I'll bring her up a bit so the aerial is clear."

The radio hissed with background noise, then a voice broke in, died away and returned an instant later.

"*Hello,* Blæksprutten, *can you hear me. Over. Hello . . .*"

"*Blæksprutten* here. What's happening? Over."

"*It is believed that you appeared on the Russian early warning radar screens. MIGs have been all over the area ever since you went up. None in sight now. We think that they did not see you come in. Please close on us and report on test. Over.*"

Arnie took up the microphone.

"Equipment functioned perfectly. No problems. Estimated height of one hundred fifty kilometers reached on battery power. Over."

He flicked the switch and the sound of distant cheering poured from the loudspeaker.

IX

The table was littered with magazines and booklets that did not interest Horst Schmidt. *Novy Mir, Russia Today, Pravda, Twelve Years of U.S. Imperialist Intervention and Aggression in Laos.* He leaned back in the chair, resting his elbow on the journals, and drew deeply on his cigarette. A pigeon flapped and landed on the windowsill outside, turning a pink eye to look at him through the water-beaded pane. He tapped the cigarette on the edge of the ashtray and, at the sudden motion inside the room, the pigeon flew away. Schmidt turned as the door opened and Lidia Efimovna Shirochenka came into the room. She was a slim, blond-haired girl, who might have appeared Scandinavian had it not been for her high Slavic cheekbones. Her green tweed suit was well cut and fashionable; undoubtedly purchased in Denmark. Schmidt saw that she was reading his report, frowning over it.

"There is precious here of any value," she said curtly, "considering the amount of money we pay you." She sat down behind the desk that bore a small plaque reading *Troisième Secrétaire de la Légation.* She spoke in German, utilizing this opportunity, as a good

party member, to a dual advantage; gaining linguistic practice with a native speaker.

"There is a good deal of information there. Intelligence, even negative information, is still intelligence. We now know that the Americans are as much in the dark as we are about the affair at Langeliniekaj. We know that their fair-weather allies, the Danes, are not acquainting their NATO comrades with all of their internal secrets. We know that all of the armed forces seemed to be involved. And, if you will carefully note the last paragraph, *tovarich* Shirochenka, you will see that I have tentatively identified one of the civilians who was aboard the *Isbjorn* during the same day when there was all that excitement. He is Professor Rasmussen, a Nobel prize winner in physics, which I find most interesting. What is the connection between this affair and a physicist?"

Lidia Shirochenka seemed unimpressed by this disclosure. She took a photograph from a drawer and passed it over to Schmidt. "Is that the man you are talking about?"

He had too many years of experience at guarding his expression to reveal any reaction—but he was very surprised. It was a very grainy picture, obviously taken with a telescopic lens under poor light conditions, yet good enough to be instantly recognizable. Ove Rasmussen, carrying a small case, was walking down a ramp from a ship.

"Yes, that's the same man. Where did you get this?"

"That is none of your business. You must realize that you are not the only man in the employ of this department. Your physicist now appears to be connected in some manner with rockets or missiles. Find out all you can about him. Who he sees, what he is doing. And do not tell the Americans about this little bit of information. That would be most unwise."

"You insult me! You know where my loyalty lies."

"Yes. With yourself. It is impossible to insult a double agent. I am just attempting to make it clear that it would be a drastic mistake for you to betray us in the same manner that you have betrayed your CIA employers. There is no loyalty for you, just money."

"On the contrary, I am most loyal." He snubbed out his cigarette, then took out his package and offered one to Lidia Shirochenka. She raised her eyes slightly at the label. American cigarettes were very expensive in Copenhagen. "Have one. I get them at PX discount, about a fifth of the usual price." He waited until he had lighted her cigarette before he continued.

"I am most loyal to your organization because it is the wisest arrangement for me. Speaking as a professional now, I can assure you that it is very difficult to get reliable intelligence information about

the U.S.S.R. You have rigorous security procedures. Therefore I am happy for the items—I presume they are false—that you supply me for the Americans. They will never discover this because the CIA is hideously inefficient and has a one hundred percent record of never having ever been correct with intelligence information supplied to their own government. But they pay very well indeed for what they receive from me, and there are many fringe benefits." He held up his cigarette and smiled. "Not the least of which is the money you pay me for revealing their little secrets. I find it a profitable arrangement. Besides, I like your organization. Ever since Beria . . ."

"Things have changed a great deal since Beria," she said sharply. "A former SS man like yourself, an Oberst at Auschwitz has little claim to moral arguments." When he did not answer she turned to look out of the window, at the long white building barely visible through the light rainfall. She pointed.

"There they are, Schmidt, just across the graveyard from us. There is something very symbolic in that, have you never thought?"

"Never," he said emotionlessly. "You have far more insight into these matters than I have, *tovarich* Shirochenka."

"Don't ever forget that. You are an employee whom we watch very closely. Try to get closer to this Professor Rasmussen—"

She broke off as the door opened. A young man, in his shirtsleeves, hurried in and handed her a piece of paper that had been torn from the teleprinter. She scanned it quickly and her eyes widened.

"Boshemoi!" she whispered, shocked. "It can't be true—"

The young man wordlessly nodded his head, the same look of numb disbelief on his face.

"How many hours now?" Arnie asked. Ove looked at the chart hanging on the laboratory table.

"Over two hundred fifty—and that is continuous operation. We seem to have most of the bugs worked out."

"I hope to say you do." Arnie admired the shining, cylindrical apparatus that almost filled the large workstand. It was festooned with wires and electronic plumbing, and flanked by a large control board. There was no sound of operation other than a low and distant humming. "This is quite a breakthrough," he added.

"The British did most of the groundwork back in the late '60's. I was interested because it related to some of my own work. I had been able to build up plasmas of 200,000 degrees, but only for limited amounts of time, a few thousand microseconds. Then these people at Newcastle on Tyne began using a helium-caesium plasma at 1,460° centigrade with an internal electric field. They were increasing

the plasma conductivity up to a hundred times. I utilized their technique to build Little Hans here. I haven't been able to scale up the effect yet, not practically, but I think I see a way out. In any case Little Hans works fine and produces a few thousand volts steadily so I cannot complain."

"You have done wonders." Arnie nodded thanks as one of the laboratory assistants handed him a cup of coffee. He stirred it slowly, thinking. "Scaled up this could be the power source we need for a true space vessel. A pressurized atomic generator, of the type now used in submarines and surface craft, would fit our needs. No fuel needed, no oxidant. But with one inherent drawback."

"Cooling," Ove said, and blew on his hot coffee.

"Exactly. You can cool with sea water in a ship, but that sort of thing is hard to come by in space. I suppose an external radiating unit could be constructed—"

"It would be far bigger than the ship itself!"

"Yes, I imagine it would. Which brings us back to your fusion generator. Plenty of power, not too much waste heat to bleed off. Will you let me help you with this?"

"Delighted. Between us I know —" He broke off, distracted by a sudden buzz of conversation from the far end of the laboratory. "Is there anything wrong down there?"

"I'm very sorry, Professor, it is just the news." She held up an early edition of BT.

"What's happened?"

"It's the Russians, that Moon orbiting flight of theirs. It has turned out to be more than that, more than just a flight around the Moon. It is a landing capsule and they have set it down right in the middle of the Sea of Tranquility."

"The Americans won't be overjoyed about this," Ove said. "Up until now they have considered the Moon a bit of American landscape."

"That's the trouble." She held the newspaper out to them, her eyes wide. "They have landed, but something is wrong with their lunar module. They can't take off again."

There was little more to the newspaper report, other than the photograph of the three smiling cosmonauts that had been taken just before takeoff. Nartov, Shavkun and Zlotnikova. A colonel, a major and a captain, in a neatly organized chain of command. Everything had been very well organized. Television coverage, reporters, takeoff, first-stage, second-stage, radioed reports and thanks to Comrade Lenin for making the voyage possible, the approach and the landing. They were down on the Moon's surface and they were alive. But something had gone wrong. What had happened was not clear from the reports, but the result was obvious enough. The men were down. Trapped. There

for good. They would live just as long as their oxygen lasted.

"What an awful way to die, so far from home," the laboratory assistant said, speaking for all of them.

Arnie thought, thought slowly and considered what had happened. His eyes went to the fusion generator, and when he looked back he found that Ove had been looking at it, too, as though they both shared the same idea.

"Come on," Ove said, looking at his watch. "Let's go home. There's nothing more to be done here today and if we leave now we can beat most of the traffic."

Neither of them talked as Ove pulled the car through the stream of bicycles and turned north on Lyngbyvej. They had the radio on and listened to the news most of the way to Charlottenlund.

"You two are home early," Ulla said when they came in. She was Ove's wife, a still attractive redhead, although she was in her mid-forties. While Arnie was staying with them she had more than a slight tendency to mother him, thinking he was far too thin. She took instant advantage of this unexpected opportunity. "I'm just making tea and I'll bring you in some. And some sandwiches to hold you until dinner." She ignored all protests and hurried out.

They went into the living room and switched on the television. The Danish channel had not come on the air yet, but Sweden was broadcasting a special program about the cosmonauts and they listened closely to this. Details were being released, almost grudgingly, by Moscow and the entire tragedy could now be pieced together.

The landing had been a good one right up to the very end. Set-down had been accomplished in the exact area that had been selected and, until the moment of touchdown, it had looked perfect. But as the engines cut off one of the tripod landing legs had given way. Details were not given, whether the leg itself had broken or gone into a hole, but the results were clear enough. The lunar module had fallen over on its side. One of the engines had been torn free: an undisclosed quantity of fuel had been lost. The module would not be able to take off. The cosmonauts were down to stay.

"I wonder if the Soviets have a backup rocket that could get there?" Arnie asked.

"I doubt it. They would have mentioned it if there were any chance. You heard those deep Slavic tones of tragedy in the interview. If there were any hope at all it would have been mentioned. They are already written off, and busts are being made of them for the Hall of Fame."

"What about the Americans?"

"If they could do anything they would jump at the chance, but they

have said nothing. Even if they had a ship ready to go, which they probably don't, they don't have a window. This is the completely wrong time of the month for them to attempt a lunar launch. By the time there is a window that trio of cosmonauts will be dead."

"Then . . . nothing can be done?"

"Here's your tea," Ulla said, bringing in the heavily loaded tray.

"You know better than that," Ove told him. "You have been thinking the same thing I have. Why don't we take the fusion generator, put it in *Blæksprutten*—and go up there to the Moon and rescue them."

"It sounds an absolutely insane idea when you come right out and say it."

"It's an insane world we live in. Shall we give it a try—see if we can talk the Minister into it?"

"Why not?" Arnie raised his cup. "To the Moon then."

"To the Moon!"

Ulla, eyes wide, looked back and forth from one to another, as though she thought they were both mad.

X

"Signing off until 1600 hours for next contact," Colonel Nartov said, and threw the switch on the radio. He wore sunglasses and ragged-bottom shorts, hacked from his nylon shipsuit, and nothing else. His dark whiskers were now long enough to feel soft when he rubbed at them, having finally grown out of the scratchy stage. They itched, too; not for the first time he wished that there was enough water to have a good scrub. He felt hot and sticky all over and the tiny cabin reeked like a bear pit.

Shavkun was asleep, breathing hoarsely through his gaping mouth. Captain Zlotnikova was fiddling with the knobs on the receiver, they had more than enough power from their solar panels, looking for the special program that was beamed to them night and day. There was static, a blare of music then the gentle melody of a balalaika playing an old folk melody. Zlotnikova leaned back, arms behind his head, and hummed a quiet accompaniment. Nartov looked up at the blue and white mottled globe in the black sky and felt a strong desire for a cigarette. Shavkun groaned in his sleep and made smacking noises with his mouth.

"Chess?" Nartov asked, and Zlotnikova laid down the well-worn, thin-paper copy of "The Collected Works of V. I. Lenin" that he had been leafing through. It was the only book aboard, they had planned to read from it when they planted the Soviet flag in Lunar soil, and, while inspiring in other circumstances, bore little relationship to their present condition. Chess was better. The little pocket set was the most important

piece of equipment aboard *Vostok IV*.

"I'm four games ahead of you," Nartov said, passing over the board. "You're white."

Zlotnikova nodded and played a safe and sane pawn to king four. The colonel was a strong player and he was taking no chances. The sun, pouring down on the Sea of Tranquility outside, hung apparently motionless in the black sky, although it crept closer to the horizon all the time. Even with sunglasses he squinted against the glare, looking, automatically, for some movement, some change in that ocean of rock and sand, mother-of-pearl, grayish green, lifeless.

"Your move." He looked back at the board, moved his knight.

"A vacuum, airless, whoever thought it would be this hot," Zlotnikova said.

"Whoever thought we would be here this long, as I have told you before. As highly polished as this ship is, some radiation still gets through. It hasn't a hundred percent albedo. So we warm up. We were supposed to be here less than a day, it wasn't considered important."

"It is after eleven days. Guard your queen."

The colonel wiped the sweat from his forehead with the back of his arm, looked out at the changeless moonscape, looked back to the board.

Shavkun grunted and opened his eyes. "Too damn hot to sleep," he mumbled.

"That hasn't seemed to bother you the last couple of hours," Zlotnikova said, then castled queenside to get away from the swiftly mounting kingside attack.

"Watch your tongue, Captain," Shavkun said, irritable after the heat-sodden sleep.

"I'm a Hero of the Soviet People," Zlotnikova answered, unimpressed by the reprimand.

Shavkun looked distastefully at the other two, heads bent over the board. He was a really second-rate player himself. The other two beat him so easily that it had been decided to leave him out of the contest. This gave him too much time to think.

"How long before the oxygen runs out?"

Nartov shrugged, bearlike and fatalistic, without bothering to look up from the board. "Two days, maybe a third. We'll know better when we have to crack the last cylinder."

"And then what?"

"And then we will decide about it," he said with quick irritation. Playing the game had put the unavoidable from his mind for a few minutes: he did not enjoy being dragged back to it. "We have already talked about it. Dying by asphyxiation can be painful. There are a lot simpler ways. We'll discuss it then."

Shavkun slid from the bunk and leaned against the viewport which was canted at a slight angle. They had managed to level off the vessel by digging at the other two legs, but nothing could replace the lost fuel. And there was the Earth, looking so close. He pulled the camera from its clip and squinted through the pentaprism, using their strongest telescopic lens.

"That storm is over. The entire Baltic is clear. I do believe I can even see Leningrad. It's clear, really clear there with the sun shining and all—"

"Shut up," Colonel Nartov said sharply.

XI

The gray waters of the Baltic hissed along the side of the *MS VITUS BERING*, breaking into mats of foam that were swept quickly astern. A sea gull flapped slowly alongside, an optimistic eye open for any garbage that might be thrown overboard. Arnie stood at the rail, welcoming the sharp morning air after the night in the musty cabin. The sky, still banded with red in the east where the sun was pushing its edge over the horizon, was almost cloudless, its pale blue bowl resting on the heaving plain of the sea. The door creaked open and Nils came on deck, yawning and stretching. He cocked a professional eye out from under the brim of his uniform cap —his an Air Force one, not SAS this time—and looked around.

"Looks like good flying weather, Professor Klein."

"Arnie, if you please, Captain Hansen. As shipmates on this important flight I feel there should be less formality."

"Nils. You're right, of course. And, by God, it *is* important, I'm just beginning to realize that. All the planning is one thing, but the thought that we are leaving for the Moon after breakfast and will be there before lunch—It's a little hard to accept." The mention of food reminded him of the vacant space in his great frame. "Come on, let's get some of that breakfast before it's all gone."

There was more than enough left. Hot cereal and cold cereal; Nils had a little of each, sprinkling the uncooked oatmeal over his cornflakes and drowning both in milk in the Scandinavian manner. This was followed by boiled eggs, four kinds of bread, a platter of cheese, ham and salami. For those with even better appetites there were three kinds of herring. Arnie, more used to the light Israeli breakfast, settled for some dark bread and butter and a cup of coffee. He looked with fascinated interest as the big pilot had one serving of everything to try it out, then went around again for seconds. Ove came in, poured some coffee and joined them at the table.

"The three of us are the crew,"

he said. "It's all set. I was up half the night with Admiral Sander-Lange and he finally saw the point."

"What is the point?" Nils asked, talking around a large mouthful of herring and buttered *rugbrød*. "I'm a pilot, so you must have me, but is there any reason to have two high-powered physicists aboard?"

"No real reason," Ove answered, ready with the answer after a night of debating the point. "But there are two completely separate devices aboard—the Daleth drive and the fusion generator—and each requires constant skilled attention. It just so happens that we are the only two people for the job, sort of high-paid mechanics, and that is what is important. The physicist part is secondary at this point. If *Blæksprutten* is to fly, we are the only ones who can fly her. We've come so far now that we can't turn back. Our risk is really negligible—compared to the certain death facing those cosmonauts on the Moon. And it's also a matter of honor now. We know we can do it. We have to try."

"Danish honor," Nils said gravely, then broke into a wide grin. "This is really going to rock the Russians back on their heels! How many people in their country . . . 226 or 227 million? And how many in all of Denmark?"

"Under five million."

"Correct—a lot less than in Moscow alone. So they have all their parades and rockets and boosters and speeches and politicians, and their thing falls over and all the juice runs out. So we come along and pick up the pieces!"

The ship's officers at the next table had been silent, listening as Nils's voice grew louder with enthusiasm. Now they burst out in applause, laughing aloud. This flight appealed to the Danish sense of humor. Small they were, but immensely proud, with a long and fascinating history going back a thousand years. And, like all the Baltic countries, they were always aware of the Soviet Union just across that small shallow sea. This rescue attempt would be remembered for a long time to come. Ove looked at his watch and stood up.

"It is less than two hours to our first lift-off computation. Let us see if we can make it."

They finished quickly and hurried on deck. The submarine was already out of the hold and in the water, with technicians aboard making the last-minute arrangements.

"With all these changes the tub really needs a new name." Nils said, "Maybe *Den Flyvende Blæksprutte*—the Flying Squid. It has a nice ring to it."

Henning Wilhelmsen climbed back over the rail and joined them, his face set in lines of unalloyed glumness. Since he knew her best, he had supervised all of the equip-

ment changes and installations.

"I don't know what she is now, a spaceship I guess. But she's no longer a sub. No power plant, no drive units. I had to pull out the engine to make room for that big tin can with all the plumbing. And I even bored holes in the pressure hull!" This last crime was the end of the world to any submariner. Nils clapped him on the back.

"Cheer up—you've done your part. You have changed her from an humble larva into a butterfly of the skies."

"Very poetical." Henning refused to be cheered up. "She's more of a luna moth than a butterfly now. Take good care of her."

"You can be sure of that," Nils said, sincerely. "It's my own skin that I'm worried about, and *Den Flyvende Blæksprutte* is the only transportation around. All the changes finished?"

"All done. You have an air pressure altimeter now, as well as a radio altimeter. Extra oxygen tanks, air-scrubbing equipment, a bigger external aerial, everything they asked for and more. We even put lunch aboard for you, and the admiral donated a bottle of *snaps*. Ready to go." He reached out and shook the pilot's hand. "Good luck."

"See you later tonight."

There was much hand-shaking then, last minute instructions and a rousing cheer as they went aboard and closed the hatch. A Danish flag had been painted on the conning tower and it gleamed brightly in the early morning sun.

"Dogged tight," Nils said, giving an extra twist to the wheel that sealed the hatch above, set into the conning tower's deck.

"What about the hatch on top of the tower?" Ove asked.

"Closed but not sealed, as you said. The air will bleed out of the conning tower long before we get there."

"Fine. That's about as close to an air lock as we can rig on a short notice. Now, are we all certain that we know what to do and how to do it?"

"I know," Nils grumbled, "but I miss the check lists."

"The Wright Brothers didn't have check lists. We'll save that for those who follow after. Arnie can we run through the drill once more?"

"Yes, of course. We have a computation coming up in about twenty minutes, and I see no reason why we should not make it." He went forward to look out of a port. "The ship is moving away to give us plenty of room." He pointed down at the controls in front of Nils, most of them newly mounted on top of the panel.

"Nils, you are the pilot. I have rigged controls here for you that will enable you to change course, we have gone over them so you know how they operate.

We will have to work together on takeoffs and landings, because those will have to be done from the Daleth unit which I will man. Ove is our engine room and will see to it that we have a continuous supply of current. The batteries are still here, and charged, but they will be saved for emergencies—which I sincerely hope we will not have. I will make the vertical takeoff and get us clear of the atmosphere. Nils will put us on our course and keep us on it. I will control acceleration. If the university computer that ties in with the radar operates all right, they should tell us when to reverse thrust. If they do not tell us we shall have to reverse by chronometer and do the best we can by ourselves."

"Now that is the part I *don't* understand," Nils said, pushing his cap back on his head and pointing to the periscope. "This is a plain old underwater periscope—now modified so that it looks straight up rather than ahead. It has a crosshair in it. I'm supposed to get a star in the crosshair and keep it there and you want me to believe that this is all we have to navigate by? Shouldn't there be a navigator—"

"An astrogator, if you want to be precise."

"An astrogator then. Someone who can plot a course for us?"

"Someone whom you can have a little more faith in than a periscope you mean?" Ove asked, laughing, and opened the door to the engine compartment.

"Exactly. I'm thinking about all those course corrections, computations and such that the Americans and Soviets have done before to get to the Moon. Can we really do it with this?"

"We have the same computations behind us, realize that. But we have a much simpler means of applying them because of the shorter duration of our flight. When time is allowed for our initial slower speed through the atmosphere, our flying time is almost exactly four hours. Knowing this, certain prominent stars were picked as targets and the computations were made. Those are our computation times. If we leave at the correct moment and keep the target star in sight all of the time, we will be aiming at the spot in the Moon's orbit where it will be at the end of the four hours. We both move to our appointed meeting place and the descent can be made—after we locate the Soviet capsule."

"And that is going to be easy?" Nils asked, looking dubious.

"I don't see why not," Ove answered poking his head out of the engine cubby, wiping his hands on a rag. "The generator is operating and the output is right on the button." He pointed to the large photograph of the Moon pasted to the front bulkhead. "Goodness, we know what the Moon looks like,

we've all looked through telescopes and can find the Sea of Tranquility. We go there, to the right spot, and if we don't see the Soviets we use the direction finder to track them down."

"And at what spot do we look in the Sea of Tranquility? Do we follow this?" Nils pointed to the blurry photograph of the Moon that had been cut from the newspaper *Pravda*. There was a red star printed in the north of the *mare* where the cosmonauts had landed. *"Pravda* says this is where they are. Do we navigate from a *newspaper* photo?"

"We do unless you can think of something better," Arnie said mildly. "And do not forget our direction finder is a standard small boat model bought from A. P. Moller Ship Supplies in Copenhagen. Does that bother you, too?"

After one last scowl, Nils burst out laughing. "The whole thing is so outrageous that it has to succeed." He fastened his lap belt. "We can proceed anytime that you are ready, shipmates. *Blæksprutten* to the rescue!"

"A few more minutes to go," Arnie said, looking at the electronic chronometer before him. "I am going to take off and get a bit of altitude."

His fingers moved across the controls and the deck pressed up against them. The waves dropped away. Tiny figures were visible aboard the *Vitus Bering*, waving enthusiastically, then they shrank and vanished from sight as *Blæksprutten* hurled itself, faster and faster, into the sky.

The strangest thing about the voyage was its utter uneventfulness. Once clear of the atmosphere they accelerated at a constant 1G. And one gravity of acceleration can not be sensed as being different in any way from the gravity experienced on the surface of the Earth. Behind them, like a toy or the projection on a large-size screen, the globe of the Earth shrank away. There was no thunder of rockets or roar of engines, no bouncing or air pockets. Since the ship was completely sealed there was not even the small drop in atmospheric pressure that is felt in a commercial airliner. The equipment worked perfectly and, once clear of the Earth's atmospheric envelope, their speed increased.

"On course—or at least we are aimed at the target star," Nils said. "I think we can check with Copenhagen now and see if they are tracking us. It would be nice to know if we are going in the right direction." He switched the transceiver to the preset frequency and called in the agreed code.

"Kylling calling *halvabe*. Can you read me? Over." He threw the switch. "I wonder what drunk thought up these code names," he mumbled to himself. The sub was the "chick" and the other station

the "lemur"—but these names were also slang terms for a quarter-litre and a half-litre bottle of akvavit.

"*We read you loud and clear,* kylling. *You are on course, though your acceleration is slightly more than optimum. Suggest a five percent reduction.*"

"*Roger will conform. Are you tracking us?*"

"*Positive.*"

"*Will you send turnover signal?*"

"*Positive.*"

"*Over and out.*" He killed the power. "Did you hear that? Things couldn't be better."

"I have cut the acceleration by the five percent," Arnie said. "Yes, things could not be better."

"Would anyone like a Carlsberg? Ove asked. "Someone has stuffed a whole case back here." He passed a can to Nils, but Arnie declined.

"Finish them quickly," he said. "We are not far from turnover and I cannot guarantee that things will not get shaken up a bit. I could reduce the thrust to zero before I turned the ship, but that would put us in free fall for a while and I would like to avoid that if I could. Aside from our personal feelings, the equipment just isn't designed for it. Instead, I shall attempt to rotate the ship one hundred eighty degrees while maintaining full thrust, at which point we will begin to decelerate."

"Sounds fine by me," Nils said, squinting through the periscope and making a precise adjustment. "But what about our course? Is that what we use this gas pipe in the deck for? The one that Henning was moaning about because it needed a hole in his pressure hull?"

"That is correct. There is a wide-angle lens system here, with an optical gunsight fitted into it."

"The kind used on fighter planes to fire the guns?"

"Precisely. You will keep the star centered as before. I envisage no problems."

"No, no problems at all." Nils looked around at the jury-rigged and hurriedly converted sub and shook his head in wonder. "Will one of you take the con for me for a minute? I have to go to the head."

Turnover went smoothly, and they would not have known they were rotating if they hadn't watched the sunlight move across the deck and up the bulkhead. A few loose objects rattled, and a pencil rolled across the deck and fell.

Time moved swiftly. The sun glared and there was some discussion of solar storms and Van Allen radiation. These were no serious menace since the pressure hull of the submarine was a solid metal barrier, incredibly thicker than that of any rocket ever launched.

"Have you thought about talking to the cosmonauts?" Ove asked. He stood in the doorway of the

engine compartment where he could watch the fusion generator and talk with the others at the same time.

"They are all pilots," Nils said. "So they should speak English."

Ove disagreed. "Only if they have flown out of the country. Inside the Soviet Union Aeroflot uses Russian. Only on international flights is English required for radio control. I put in six months there, at Moscow University, so I can talk to them if I have to. I was hoping that one of you was more fluent."

"Hebrew, English, Yiddish or German," Arnie said. "That's all."

"Just English, Swedish and French," Nils told them. "It looks like it is up to you, Ove."

Like most Europeans with college education they took it for granted that you spoke at least one language other than your own. Like Scandinavians, two or three other languages were more likely. They assumed that the cosmonauts would speak something they could understand.

The computer kept track of their progress and, when the four hours were nearing their end, they were informed that they could turn on their radio altimeter because they were nearing the point where it would be effective. Its maximum range was one hundred fifty kilometers.

"Getting a fringe reading," Nils called, excited. "The Moon is down there all right." Since midpoint they had not seen the satellite which was beneath their keel.

"Let me know when we are about one hundred kilometers above the surface," Arnie said. "I'll roll the ship then so we can see through the side ports."

There was a growing tension now as the space-going submarine hurtled down towards the Moon, still out of sight below them.

"The altimeter is unwinding pretty fast," Nils said, his controlled pilot's voice showing none of the tension he felt.

"I'll raise the deceleration up to 2G's," Arnie said. "Stand by."

It was a strange sensation, as though they were suddenly growing heavier, with their arms pulled down and their chins sinking to their chests; their chairs creaked and their breathing labored. Nils moved his hand to the controls and it felt as though weights hung from his arm. He weighed over four hundred pounds now. "Rate of drop slowing," he said. "Coming up on one hundred kilometers. Rate of drop slowing to near zero."

"I'm going to hover at this altitude while we look for the target area," Arnie said. Thankfully. He was too obviously aware of the thudding of his heart as it labored to pump blood in the doubled gravity. As he adjusted the controls weight fell away, to one gravity, and past that, until it felt as though they would float free.

Hovering now they were in the grip of the Moon's gravity field, a mere one-sixth of that of the Earth. "Rotating," he said.

Loose objects rolled across the deck and clattered against the wall as they tilted over; they clung to the arms of their chairs. White light flooded in through the port.

"*Ih, du Almaegtige!*" Nils whispered. There it was. Filling the sky. Less than seventy miles below them. Cratered, streaked, pitted, dead and airless, another world. The Moon.

"Then we've done it," Ove said. "Done it!" he shouted with rising excitement. "By God we've crossed space in this tub and we've reached the Moon." He unhooked his belt and stood, staggering as he tried to walk in the lessened gravity. Sliding, half falling, he slammed into the bulkhead, unheeding, as he braced himself to look out of the port.

"Just look at that, will you! Copernicus, the Sea of Storms, now where would the Sea of Tranquility be. To the east, in that direction." He shaded his eyes against the reflected glare. "We can't see it yet, but it has to be that way. Over the curve of the horizon."

Silent as a falling leaf *Blæksprutten* tilted back to the horizontal, then rotated about an invisible axis. They had to lean back to balance themselves as the bow swung down and the Moon reappeared, this time directly ahead.

"Is that enough of an angle for you to see to navigate by?" Arnie asked.

"Fine. There's worse visibility from an airliner."

"Then I shall hold this attitude and this height and switch forward and lateral control to your position."

"On the way." Nils hummed happily to himself as he pressed gently on his control wheel.

The three cosmonauts stood at attention, as best they could in the cramped module with limited floor space: Zlotnikova had his nose pressed practically against the colonel's hairy shoulder. The last notes of "The International" died away and the radio speaker hissed gently with static.

"At ease," Nartov ordered, and the other two dropped into their bunks while he picked up the microphone and switched it on. "In the name of my fellow cosmonauts I thank you. They stand behind me, and agree with me, when, in this moment of victory, I say that you, fellow citizens of the Union of Soviet Socialist Republics, should not grieve. This is a victory, for all, for the Party Chairman, Members of the Presidium, workers in the factories where parts of the rocket and capsule were manufactured, to be assembled by—"

Captain Zlotnikova's attention

wandered: he had never been one for either making speeches or listening to them. Stolidly, he had listened to thousands upon thousands of hours of speeches during his twenty-eight years on Earth. And on the Moon. They were an accepted evil, like snow in the winter and drought in the summer. They were there, whether one liked it or not, and nothing could be done about them. Best to ignore them, and suffer them, which is where a fatalistic, Slavic state of mind helped. He was a fighter pilot, one of the best, and a cosmonaut, one of the few. Attaining these goals was worth any sacrifice. Listening to speeches was only a minor bother. Even death was not too high a price to pay. He had no regrets; the game was worth the candle. But he just wished it could be done with a few less speeches. The colonel's voice droned on and he glanced out of the viewport, then turned quickly away since at least an appearance of courtesy was called for. But the colonel had his back turned, with his right fist clenched in a salute and marking time to the strong rhythm of his words. It must be a good speech. At least the colonel was enjoying it. Zlotnikova turned back to the port—then tensed abruptly at the slowly moving speck of light high above. A meteor? Moving so slowly?

". . . And how many died in battle to preserve the freedom of our great land? The Red Army never hesitated to embrace death for the greater good, peace, freedom, liberty and victory. Should Soviet cosmonauts shirk responsibilities, or ignore the realities of" —angrily, he brushed away the bothersome hand that was tapping him on the shoulder—"the realities of space flight, of the complexity . . ."

"Colonel!"

". . . The complexity of the program, the great machines, the responsibilities"—*bothering him in the middle of this speech, was the man mad?*—"to all the Soviet workers who made possible . . ."

Colonel Nartov wheeled about to glare and silence the captain. But his gaze followed Zlotnikova's pointing finger to the port, through the thick glass, across the cratered, airless moonscape to the small submarine which was slowly settling down out of the star-flecked sky.

The colonel coughed, gasped, cleared his throat, and looked at the microphone in his hand with something resembling horror. "I will complete this call later," he said abruptly, and switched off. "What is that?" he roared.

For obvious reasons, neither of the other men answered. They were shocked, silent, and the only sound was the whispering of their last bit of depleted atmosphere coming through the grill, the mutter from the radio of distant music as someone back on Earth started the

band playing again to cover the untimely silence from the Moon.

Slowly the submarine settled, no more than fifty meters from their capsule, hovering daintily the last few centimeters above the gravel before easing itself down. There were some strands of very dehydrated seaweed plastered to its keel, thin streaks of rust at the stern.

"*Danish?*" Shavkun gasped, pointing to the flag painted on the small conning tower. "That is Danish, isn't it?" Zlotnikova nodded, silently, then realized that his jaw was gaping open and closed it with a sharp click. The radio rustled and squealed and a voice came in over the music in very loud, very bad, Russian.

"Hello *Vostok IV,* can you read me? This is *Blæksprutten* and I have landed near you."

Colonel Nartov looked at the microphone in his hand and started to turn it on. He stopped and shook his head, trying to rally his thoughts, then reached for the radio controls. Only after he had cut the output power to a trickle did he switch on the transmitter. For some automatic defensive reason, he did not wish Moscow to hear this conversation.

"This is *Vostok IV,* Colonel Nartov. Who is that speaking? Who are you? What are you doing here . . ." The colonel cut himself off abruptly, feeling that he was about to start babbling.

Aboard *Blæksprutten,* Ove listened and nodded. "Contact established," he told the others. "Better put that curtain up now while I get them over here." He switched the radio on. *"Govoreetye ve po Angleeskee?"* he asked.

"Yes, I speak English."

"Very good, Colonel," Ove said, changing with some relief to that language. "I am pleased to tell you that we are here to bring you back to Earth. In your broadcast a few minutes ago you said that all three of you are all right. Is that true?"

"Of course, but . . ."

"That's fine. If you would get into your spacesuits . . ."

"Yes, but you must tell me . . ."

"First things first, if you please, Colonel. Do you think you could put on your suit and step over here for a minute? I would come myself, but we don't have any space gear. If you don't mind?"

"I am on my way." There was a certain positiveness in the way the message ended.

"The colonel didn't sound so happy for a man whose life had just been saved," Nils said, threading the line through the grommets in the large tarpaulin that was spread out on the deck. It was gray and weatherstained, with a certain memory of fish lingering about it, perhaps from being stored near the marine life specimens in the hold of the *Vitus Bering.*

"He's happy enough, I imagine," Ove said, going to help the others with the clumsy canvas. "But I guess it will take a little getting used to. He was in the middle of a very dramatic sort of deathbed speech when we interrupted."

They threaded the lines through ringbolts in the ceiling and hauled it up. It made a wrinkled barrier the width of the small cabin, cutting off sight of the Daleth unit and the fusion generator.

"Better not tie down this corner," Ove said. "I have to get past it to reach the engine compartment."

"It doesn't seem a very effective barrier," Nils said.

"It will do," Arnie told him. "These men are officers and presumably gentlemen—and we are saving their lives. I do not think they will cause any trouble."

"No, I guess not . . ." Nils looked out of the port. "Say, their lock is opening—and here comes someone. Probably the colonel."

Colonel Nartov still had not adjusted to the changed circumstances. He had put on his spacesuit with automatic motions, ignoring the excited speculation of the other two cosmonauts, then stood calmly while they checked and sealed it. Now, jumping the last few feet to the surface of the Moon, he took a grip on himself. This was really happening. They were not going to die. He would see Moscow, his wife and family, again, and that was a pleasant thought. This strange craft had come to the Moon so it could undoubtedly return to Earth. Details would be explained later. Bringing his men back alive was his first concern. Head up, he strode towards the submarine, the dust and pebbles kicked up by his thicksoled boots falling back instantly to the airless surface.

A man was visible in the round port above, wearing a peaked cap of some kind, pointing downwards with his finger and nodding his head. What on Earth—or the Moon—could it mean? When the colonel came closer he saw that a thick-lidded box had been hurriedly welded to the hull. It was labeled ТЕЛЕФОН in black Cyrillic characters. He loosened the large thumb screw that held the cover into place, then swung it open and took out the telephone handset that was on a bracket inside. When he pressed it hard against his helmet the vibrations of his voice carried through well enough, and he could understand the man on the other end.

"Can you hear me, Colonel?"

"Yes." The cord was long enough so that when he stepped back he could see the man with another telephone through the port above.

"Good. I'm Captain Nils Hansen, Danish Air Force, Senior Danish Captain with SAS. I'll introduce the others when you come

aboard. Can you reach the deck above you?"

The colonel squinted upwards against the glare. "Not now. But we can attach a rope, working together, or something. The gravity is very light."

"It shouldn't be hard. Once on deck you will find that there is a hatch on top of the conning tower, unsealed. The conning tower is just big enough to hold three men, with crowding, and you will all have to come in at once since it is not a proper air lock. Get in, seal the top hatch just as tightly as you can, then knock three times on the deck. We'll let the air in then. Can you do this?"

"Of course."

"Can you bring whatever oxygen you have left? We don't want to run short on the return trip. We should have enough, but it doesn't hurt to have some extra."

"We will do that. We have just tapped our last cylinder."

"One final thing before you go. We have some . . . secret equipment aboard, out of sight behind a screen. We would like to ask you to avoid going near it . . ."

"You have my word," the colonel said, drawing himself up. "And my officers will give you their word as well." He looked at the big-jawed, smiling man through the thick port and, for the first time, the reality of this last minute reprieve struck home to him. "I would like to thank you, for all of us, for what you are doing. You have saved our lives."

"We are glad to be here, and very happy that we could do it. Now . . . "

"We will be back. In very few minutes."

When he returned to the capsule the colonel could see the two faces watching him through the port, close together, pressed to the glass like children at the window of a candy store. He almost smiled, but stopped himself in time.

"Get your suits on," he said when he had cycled through the lock. "We are going home. Those Danes are taking us." He switched on the radio and picked up the microphone in order to silence their stammered questions. The distant band, now playing "Meadowland" moaned and died as his call went out.

"Yes, Vostok IV, *we hear you. Is there any difficulty? Your last message was interrupted. Over."*

The colonel frowned, then switched on.

"This is Colonel Nartov. This is a final message. I am switching off and closing communication now . . ."

"Colonel, please, we know how you feel. All Russia is with you in spirit. But the general wishes . . ."

"Tell the general that I will contact him later. Not by radio," he took a deep breath and kept his thumb on the switch. "I have his

Kremlin telephone number. I will call him from Denmark." He switched off quickly and killed the power. Should he have said more? What *could* he have said that would have made any sense? Other countries would be listening.

"Oh hell," he snapped at his two wide-eyed companions. "Major, get the log books, film, records, samples, put them into a box. Captain, close the oxygen cylinder and unship it so we can take it with us. We'll go on suit oxygen now. Any questions?" There was only silence so he snapped his faceplate closed.

"Here they come," Nils called out a few minutes later. "The last one just climbed down and they have closed the air lock. They are bundled down with a lot of junk, records and such I imagine, one of them even has a camera. Say—he's taking pictures of us!"

"Let them," Ove said. "They can't learn a thing from the photographs. You know, we should have some specimens, too. Before they climb aboard get the colonel on the phone again. Tell him we want some rocks and dirt, something to take home."

"Specimens brought back by the First Danish Lunar Expedition. Good idea, since we can't go outside ourselves. How is it going?"

"Fine," Ove said, opening a bottle of akvavit and placing it beside the little glasses on the map table. "We should have thought to bring some vodka, but I bet we'll hear no complaints about this *snaps*." He opened one of the *smørrebrø* containers that the cook had packed that morning, and slid out the openfaced sandwiches inside. "The herring is still fresh, they'll like that, and there's liver paste here as well."

"I'll eat it myself if they don't get here pretty soon," Nils said, eyeing the food hungrily. "Here they come."

He waved cheerfully through the port at the three laden figures trudging across the lunar plain.

To Be Continued

Is Biological Aging Inevitable?

For ages men have talked about long life; science fiction assumes it as an almost "of course" of the future. This article is a careful, objective review of what is actually known, or suspected, about aging— and why nobody is doing much about it!

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Must man biologically age? Is it forever ordained that we must gradually lose our capability to fend off incipient disease, until death finally intervenes? These are critical questions . . . for no one dies of old age! Each of us dies of specific, often multiple, diseases resulting from the progressive weakening of our system as we grow older. Certainly aging—and its mistress, death—seem to be as intrinsic to us as breathing and eating, but is this necessarily so? Through the creeping millennia, man has emotionally argued these vital questions, often resorting to devious religious, philosophical and proto-scientific reasonings. Some of the resultant ideas have played prominent roles in our evolving culture and they influence us strongly, even today.

Yet, until recently, precious little had been done to alleviate this

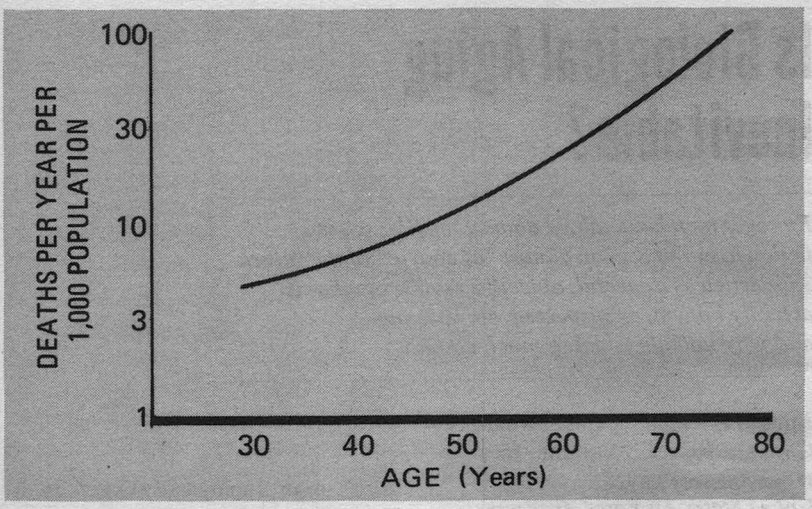


Figure 1. Gompertz plot: log of the death rate v. age.

seemingly inevitable bane. In fact, many men have actually suggested that aging should not be studied—that biological aging and death are somehow beneficial both to individuals and to mankind. But their arguments sound suspiciously similar to those which were used against anatomical research during the Renaissance; and fortunately, not all humans pay attention to them. We'll discuss some of those arguments later but right now let's look at some creative efforts in the endeavor to conquer aging.

Early Scientific Efforts

Only in the last century and a half has consideration of biological aging slowly shifted to a scientific approach. Rather than succumb to the lethargy which accompanies hopelessness, some scientists have studied—often in a most primitive way—the aging process. At first the proposed theories and experiments appeared completely unrelated to each other; the situation was somewhat like that of the blind men and the elephant—all were seeing different aspects of the same thing. Although all were partially wrong, they were also partially right. And continually, the scientists have had to struggle against both active opposition and lack of interest . . . a result of the subtle apologistic themes intricately interwoven throughout the warf and woof of our culture.

There were isolated, groping attempts at scientific approaches dur-

ing the seventeenth, eighteenth and nineteenth centuries, but mankind was lacking the necessary tools and essential background knowledge, and there was little solid progress. Perhaps the first successful attempt to formulate a mathematical model was made by Gompertz in 1825. He plotted the log of the death rate of different sample groups of humans as a function of age and, not unexpectedly, found that the death rate—or the probability of death at any age—for each sample group increased rapidly as the group aged (Figure 1). Although this empirical model did not establish a cause for aging, it did demonstrate that death is not a purely random event* and that people become increasingly unable to withstand the stresses of their environment as they age.

With the beginning of this century came increased, less crude attempts to study the phenomenon of aging. In 1908, Ruebner astutely observed that among a wide variety of animals there is a curious relationship between the metabolic rate and the life span: the greater the metabolic rate, the shorter the life span. For example, mouse and man each expend approximately seven hundred calories per gram of tissue throughout their lives but the mouse expends its energy at roughly thirty times the rate that man does—and lives about one thirtieth as long. The basic reason for the mouse's greater rate of energy expenditure is that each gram of mouse tissue has far more surface area—on the mouse's skin—through which to lose heat than does each gram of human tissue—through human skin. Thus, the mouse must have a greater metabolic rate just to maintain the same body temperature.

The important point is that a variety of animals undergo similar aging changes given the same amount of chemical activity. This relationship seemed to imply that exercise should be taken only in very small doses—if at all. The lower rate of energy expenditure should then result in an extended life span. That concept was eventually developed into a "Rate of Living" theory. Twenty years after Ruebner's original observations, the "Rate of Living" theory was hopefully tested by Pearl on one type of organism—man; however, no consistent relationship could be shown between life span and the amount of work done. It has since been suggested that compensating factors are involved, and that while the theory tends to hold between different types of organisms, these compensating factors mask the effect between organisms of the same type. This may well be true. The beneficial effects of exercise could easily outweigh the adverse

*If death were a purely random event, the probability of death during any one year timespan would remain constant throughout life. But the probability of death does not remain constant, instead it increases with age.

effects of greater metabolic activity, and the only conclusion that could be reached forty years ago was that the degenerative changes which are associated with aging are also related in some unknown chemical fashion to the metabolic rate.

In 1923, Carroll and Eberling evolved what was actually an improvement upon Ruebner's "Rate of Living" concept. They suggested a specific way in which an organism's metabolic rate might be related to its life span. They came up with the interesting idea that some metabolic waste products might not be excreted as rapidly as they are formed—a concept which could have evolved from Aristotle's "clash of the body's elements." Those waste products would then accumulate, slowly poisoning the organism or otherwise interfering with its operation. Such a "Waste Product" theory is easy to test: Carroll and Eberling ran a series of experiments in which they examined the blood of older people, looking for molecules which might inhibit growth or metabolism. However, they were unable to obtain conclusive evidence for this theory. Part of the reason for their failure was that they were looking in the wrong place. Later researchers have found chemically-inert collections of molecules within the body cells—not the blood—of organisms. Some of these molecules appear to be metabolic waste products while other molecules appear to be normal body molecules that have been oxidized or chemically-bound to other molecules, thus "clogging the system" as visualized by the "Waste Product" theory.

In the case of human nerve and muscle cells, some of those chemically-inert collections of molecules form fluorescent lipofuscins which are, at present, believed to be multi-oxidized lysosome molecules. (Lysosome molecules are digestive enzymes which are contained in sacs within the body's cells. When a cell is damaged sufficiently for an internal sac's wall to become ruptured, the lysosome molecules are freed. They proceed to disassemble the damaged cell.) If the lysosome molecules within a cell become chemically inert—multi-oxidized—they not only are unable to disassemble the cell when it becomes damaged, but they also may interfere with the cell's metabolism.

In the human heart muscle, the fluorescent lipofuscins can accumulate with age to where they total as much as 30% of the heart muscle's weight. It would be strange if replacement of 30% of a muscle by inert material did not have some adverse effect upon the muscle's performance! However, no firm conclusion can be reached regarding the validity of the "Waste Product" theory until we learn how to remove the waste products

and other inert molecules without damaging the organism. Then, we can see if removal of the useless material noticeably benefits the organism. Until then, all we have succeeded in finding is a correlation between aging and the accumulation of inert molecules. Of course, that correlation does not prove that the accumulation of inert molecules produces aging. There is a definite correlation between baldness and aging but would you claim that baldness causes aging?

A more dramatic approach was tried by Serge Voronoff. During the 1920s he observed that serious hormonal imbalances occurred in elderly people. Voronoff attempted to rectify partially the imbalance condition in elderly men by transplanting—to over 1,000 of them—testicles from male chimpanzees. This produced only temporary improvement in the elderly men . . . and none in the chimpanzees. Perhaps he would have been slightly more successful with the men if he had been able to control the body's immunologic rejection of foreign tissue. Unfortunately, such important knowledge was not available in his day, but even if it had been, he might not have achieved any great success against aging.

Hormonal therapy is in use today, and although side effects and lack of knowledge limit the effectiveness of treatment, there is little solid evidence that those limitations are preventing man from achieving large extensions in lifespan. However, further experimentation is necessary to resolve this matter. (Proper practice of preventative endocrinology could add between five and ten years to the mean life span, as well as make the later years more vigorous, healthy and enjoyable.)

In the late 1930s, the last of the early empirical scientific efforts against aging was initiated. Bogomoletz studied a group of Russians whose age ranged from 107 to 138 years. After many extremely detailed physical examinations and postmortems he concluded that the state of preservation of the connective tissue has a major affect upon life span. He then developed a serum which was intended to improve the condition of elderly connective tissue but the serum had little, if any, effect on life span. As a result both Bogomoletz and his serum fell into disrepute with Western scientists. Recently though, new evidence suggests that his basic conclusion was at least partially right—only his serum was completely wrong. It should be pointed out that Bogomoletz and his theory are still held in high esteem among Russian gerontologists.

Recent Scientific Progress

In 1941, the first of the exciting modern scientific efforts against aging was begun. Johan Bjorksten

brilliantly proposed his "Crosslinkage" theory of aging (crosslinked-chemically-bound-together) in which he originally viewed monatonically increasing crosslinkage between protein and/or nucleic acid molecules as the basic cause of biological aging. That view has now been broadened to include crosslinkage between all types of large, biologically important molecules as being the basic cause of biological aging. It is well known that when a given molecule chemically combines with another atom or molecule, the original molecule's chemical and physical behavior is altered, and frequently the original molecule is then unable to perform its proper function. Thus, the progressive crosslinkage of molecules in an organism would lead to the progressive deterioration of chemical and physical performance, and to the eventual death of the organism. This theory has received increasing experimental support over the past quarter century and now stands as one of the most impressive of the modern theories.

An interesting side point is that essentially this same crosslinkage theory has been independently proposed by three different scientists working from three different viewpoints. Johan Bjorksten was first by about fifteen years; with his customary genius, he evolved the theory from the most difficult viewpoint—that of a chemist. Frederick Verzár deduced a variation of the theory next. He did this in 1956 from the viewpoint of a medical doctor and biochemist. The last individual to independently arrive at essentially the same conclusion was Donald Carpenter; in 1959 he reached this conclusion from studies of nuclear science and radiation effects. The important point is that three scientists independently evolved their own variations of essentially the same theory —each without knowledge of the other's work, and each working from a different scientific viewpoint. Of course, that proves only that the concept is highly plausible.

The variation developed by Verzár in 1956 has been referred to by many as "Collagen" theory. In essence, this theory holds that collagen—a fibrous protein accounting for about 40% of a human's total protein—tends both to increase in amount and to crosslink slowly, but progressively, with age. The progressive crosslinkage causes the collagen fibers to shrink with age* and to "choke-off" the surrounding tissue; thus the surrounding tissue becomes increasingly anoxic — oxygen-starved — and wrinkled. Such an environment forms an excellent breeding ground for cancer, and cancers do indeed tend to form in the crosslinked collagenous regions which exist along the edges of old scars.

The variation developed by Car-

*As in the twisting of a rope, which causes it to "shrink" in length.

penter in 1959 is called "Diffusion" theory. This theory holds that biological aging can be treated as a diffusion phenomenon: some large molecules in the organism are produced at a more rapid rate than that at which they are removed. These accumulating molecules can be produced by both normal and abnormal chemical reactions within the body. The successes of "Diffusion" theory are in explaining: (a) the accumulation of crosslinkage in rat tendon collagen (crosslinked collagen molecules are limiting cases with diffusion rates of zero); (b) the lack of observable biological aging in rapidly growing tissue; and (c) the accumulation of lipofuscins in the human heart muscle. On the other hand, this theory's greatest failure has been its inability to explain the "Lansing Effect" in which there is an inverse relationship between the mother's age at the birth of her offspring and the life span of that offspring.

In 1956, the dean of stress research—Hans Selye—proposed a "Stress" theory of biological aging in which he assumed that the everyday stress of life causes wear and tear upon the body. He suggested that a stressful situation would produce damage to the organism, and that a good rest would almost, but not quite, return the organism, to its pre-stress condition. This gradually increasing sum of stress-damage is thus what we call aging. "Stress" theory not only has all of the good points of the old "Rate of Living" theory—also called the "Wear and Tear" theory—but it also emphasizes the fact that excessive stress can terminate an organism's life. Furthermore, it emphasizes the fact that the older an organism is, the less stress it can withstand before becoming either ill or dead. Unfortunately, experimental data do not reveal a very direct correspondence between stress and aging.

Another 1956 development was the important proposal by Joseph Still of a "Cybernetic" theory of aging. Still quite correctly pointed out that every organism must be treated as a system and that organismal death can occur without any vital cells being dead. (He pointed to the possibility that the system could be disrupted by small changes in nerve transmission time.) From this viewpoint, aging is due to a gradual loss of the nervous system's control over the organism's cells; death results from passing a limit of the system. In providing experimental evidence to support this theory, Still succeeded in proving that nerve cells contain stable chemical materials. These materials could be removed from the metabolic pool through crosslinkage. Thus, Still's "Cybernetic" theory and Bjorksten's "Crosslinkage" theory a-e not only compatible, they are actually supplementary. In addition, the "Cyber-

netic" theory links physiological aging to molecular changes in the organism, but the theory is very general in nature. One has the distinct impression that this theory should be used as a framework within which other theories act as functional blocks.

In 1958, a "Mutation" theory of aging was suggested independently by Curtis and Gebhard, Szilard, and Failla. Within this group of scientists, only Howard Curtis has pressed this approach vigorously. The mutation approach postulates that the organism's somatic cells develop spontaneous mutations in the same way as do the organism's germ cells. Mutations can be produced by both crosslinkage and dissociation, as well as by deletions—vacancies—and nucleotide substitutions—replacements—when in radiation environments. These mutations can be propagated by subsequent cell divisions, and eventually the organism may be carrying a heavy body burden of mutations.

The mutations can cause essential body cells to lose the ability to translate certain chemical code "words," and such a loss of translation ability limits the cells' abilities to synthesize molecules. Because almost all mutations are harmful, the organism's cells become less like their original appearance and much less efficient. Eventually, the organism becomes so inefficient that it is unable to survive. Curtis has gathered much impressive evidence supporting this outstanding theory. For example, the number of mutations in an organism increases with age, and those species with higher mutation rates tend to have shorter life spans. However, Curtis has also pointed out that the amount of somatic mutations in an organism at any given time is inadequate to explain aging and death, unless some other factors are involved.

Another such factor was suggested by Raymond Walford in 1962. He advanced the "Immunologic" theory of aging, in which it is postulated that mutated cells stimulate immunologic reactions within the organism's system, and that those immunologic reactions degrade and eventually destroy the organism. This important concept is supported by the increased incidence of immunologic diseases—such as arthritis—with age, but is opposed by the fact that not all elderly people develop immunologic diseases. Also, when twenty-two mice were fed 100 mg. of Imuran—an immunologic reaction suppressor—per kg. of food, their mean life span was only about 10% longer than that of the twenty-five specimens in the control group. This implies that the "Immunologic" theory is valid, but is only a part of the total picture.

Also proposed in 1962 was the "Free Radical" theory of Denham Harmon. Harmon suggested that chemical free radicals within an

organism cause aging through combination with biologically important molecules. Chemicals which decrease the density of free radicals were administered to LAF_1 mice in a program of preventative therapy, and mean life span extensions of up to 50% were reported. Of course, this theory primarily emphasizes that crosslinkages can occur through the action of free radicals, but actual organisms contain many other crosslinkage agents besides free radicals—e.g., Aldehydes, Lipid oxidation products, Sulphur, Alkylating agents, et cetera. Again, we have here a prominent theory which appears to be correct so far as it goes, but which accounts for only a small part of the total effect.

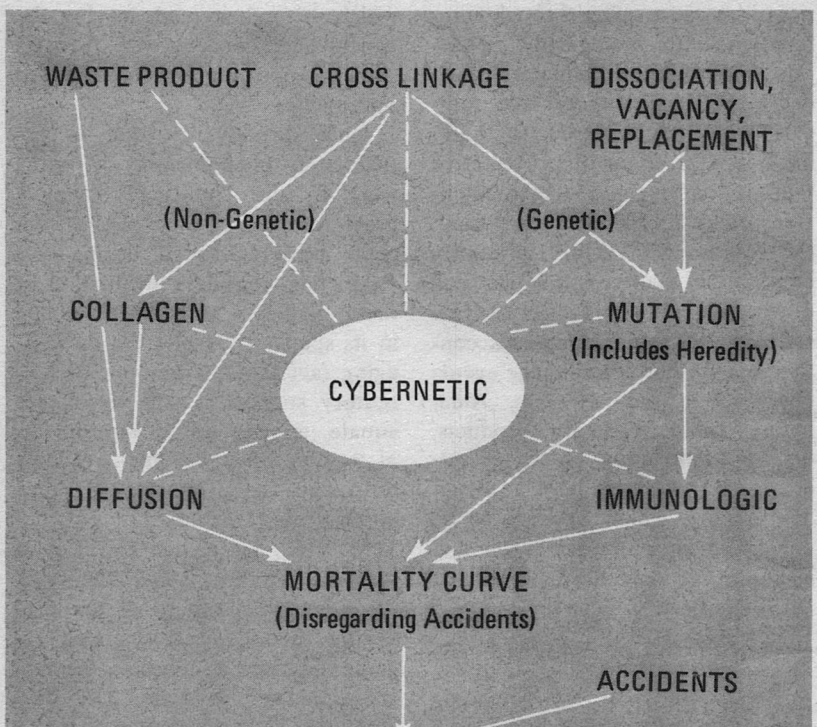
Integrated Theory of Aging

The inability of the foregoing important theories—and others—to present individually a comprehensive theoretical picture of the causes of biological aging should not be considered as discouraging. It is the nature of scientific research that the initial stages of most research efforts are characterized by the proposing of a great number of theories. There is usually a separate theory suggested to explain each different aspect of a given phenomenon under study. (This is often considered to be the "hunting" stage of research.) Eventually, however, laboratory work sifts this crude material—eliminating that which is useless, and leaving the worthwhile concepts to form a sound basis for more sophisticated approaches.

Until recently, attempts to explain the phenomenon of aging were in the "hunting" stage; a great number of worthwhile concepts were advanced during this stage, but laboratory evaluation of these concepts was most notable in its sparsity. Despite the discouraging fact that the amount of laboratory support is still very inadequate, enough useful experimental results have become available to permit the proposing of more sophisticated theories.

In 1968, Carpenter and Loynd suggested an "Integrated" theory of aging in which many of the preceding theories were blended together to form a cohesive theoretical picture (Figure 2). The "Integrated" theory assumes that (1) the major cause of aging is crosslinkage of all types of molecules within the organism, (2) the crosslinkage rate is roughly proportional to the metabolic rate and is dependent upon the density of chemical crosslinkers within the system, and (3) some types and amounts of increased stress upon the organism result in biochemical changes which enhance the rate of crosslinkage.

The modes through which this detrimental crosslinkage affects the organism are separated—according to function—into (a) the non-



genetic mode and (b) the genetic mode. The non-genetic mode includes treatment of both collagenous and non-collagenous molecules. Both of these types of molecules obey diffusion relationships; additionally, waste products also accumulate in accordance with diffusion relationships. On the other hand, the genetic mode is principally concerned with genetic material. The crosslinkage of such material produces mutations, but mutations are also normally pro-

Figure 2. Flow chart of the Integrated Theory of Aging. Cybernetic theory actually applies to the organization of the entire chart but (for this representation) has been arbitrarily assigned a position symbolizing control and feedback.

duced by dissociation; in a radiation environment further mutations result from radiation-induced deletions and nucleotide substitutions. The effect of the mutations is strongly enhanced by immunologic reactions.

The genetic structure of each organism determines the molecular shapes, locations and functions of the organism's component parts. In turn, if many parts do not function adequately the organism will die. Thus, because of its genetic structure, each organism has a definite minimum molecular efficiency—about 83%—above which it must operate in order to survive. (For example, a hummingbird most likely would not survive if it operated at the metabolic rate of a turtle. Thus, if a sufficient number of energy-conversion molecules became inactive within the hummingbird's cells, it most probably would die.)

When an organism's genetic material is adversely mutated, succeeding generations of the organism's body cells are poorly structured for inter-cellular cooperation and survival. This means that the organism can ill-afford to lose the use of any of those functional molecules which are essential to its life processes. Thus, the minimum molecular efficiency required for the organism's survival is increased; it is further increased because of immunologic reactions—perhaps to 85%.

However, mutations and immunologic reactions do not appear to be the major cause of aging and subsequent death. The major cause appears to be a decrease in molecular efficiency—where such decrease is primarily brought about by the changing of non-genetic molecules by crosslinkage. In some parts of each organism, the normal "turnover"—chemical replacement—of molecules is sufficient to prevent accumulation of inert molecules and mutations but nerve cells, muscle cells, and collagen do not "turnover." In those last three items, crosslinkage gradually removes molecules from the "normal" category, and the molecular efficiency—number of remaining "normal" molecules times 100% divided by the number of original "normal" molecules—decreases with age. The difference between an organism's actual molecular efficiency and its minimum molecular efficiency required for survival is a measure of how much stress the organism can stand—ex. youth 96-83 = 13%, old age 89-85 = 4%. Whenever the applied stress exceeds the organism's capability to withstand it, the organism dies.

Now comes the question: does the "Integrated" theory actually provide a comprehensive theoretical picture of the way that real biological aging and death occurs? In all honesty, we don't know! The theory is plausible but that does not mean that it is right. It merely

seems to interrelate the known facts better than has been done previously. If we really wish to determine the truth of the matter, we need to make a coordinated experimental and theoretical assault on biological aging.

Assault on Biological Aging

Other than to satisfy our insatiable thirst for knowledge, are there any constructive reasons why we should try to understand the physical processes underlying biological aging? The answer to that challenging question lies in the intriguing fact that, almost invariably, understanding brings control. A deep knowledge of the basic causes of biological aging could conceivably lead to a retardation or an arresting of the biological aging process. This, in turn, would yield at least three vitally important results: 1) the productive life span of individuals would be extended; 2) the onslaught of degenerative illnesses associated with advanced biological age would be postponed—giving medical research more time in which to develop effective treatments; and 3) with an increase in the average age, the attitudes of the populace on the problems—social, economic, et cetera—faced by our nation and our world would be far more mature, leading to more long-term, beneficial solutions.

To illustrate the outstanding significance of those three results, we will examine some of the benefits which would follow from just one of them—increasing the individual productive life span. In a long-range sense, the output of scientists, engineers and other experts would increase because a smaller portion of their lives would be taken up by education, thus leaving a relatively longer period of productivity. Of course, continuing professional education would be required at periodic intervals just as it is needed today. Nevertheless, a greater percentage of one's life could be devoted to gaining valuable operational experience and to applying this valuable experience to the material and mental betterment of the human race. In turn, this would lead to dramatic improvement in the present miserable condition of the world's poor, and to significantly increased rates of scientific progress in all fields. And, of course, a longer productive life span would also give us more time for fishing.

Considering the enormous benefits to be possibly reaped from organized research on biological aging, why weren't well-financed research programs started years ago? Well, in the first place, only during the last quarter century has enough background information become available to make such research programs feasible. Even now, very few people are aware that this essential background information exists. The second reason for delay

in the starting of such research programs is the type of response obtained from individuals who have not had time to evaluate carefully the available information. Even people who are trained to think logically usually respond that it is impossible to change the rate of biological aging—and then they give one or more apologistic reasons as to why it is impossible. (In one case, a physicist known to the authors stated rather matter-of-factly. "If God wanted man to live longer, he would.") Furthermore, people naïvely assume that increasing the life span means increasing only the period of decaying senescence rather than the useful middle years. Naturally, such attitudes are wrong. Yet, because of these attitudes—which have been implanted in peoples' subconsciouses by the apologistic themes in our culture—there is significant opposition to research on aging.

This opposition shows up in several ways. First, it is difficult—but not impossible—for researchers to obtain financing for their projects. This drives researchers into working on projects where funds are more readily available. Second, it is difficult to interest scientists in working on biological aging because neither researchers nor graduate students want to "waste" their time examining what they wrongly believe is tenuous evidence. Third, no funding agency is willing to provide the necessary leadership and organization which are at present so conspicuously absent although at least one nationally-known drug company has hired an independent laboratory to investigate biochemically the crosslinkage theory of aging. Of course, these foregoing comments apply only to the Western nations. Russia, on the other hand, has been involved in organized research on biological aging since the 1930s. L. V. Komarov of Moscow has stated that there is no apparent biological barrier to man's living to age 200. In contrast, the United States' attitude towards research on aging is revealed by the Department of Health, Education, and Welfare's assignment of biological aging research to the National Institute of Child Health and Human Development. The Department's Section Head for biological aging research, Bernard Strehler, became so disenchanted with HEW's attitude in 1967 that he resigned, accepted a position with the University of Southern California, and started a non-profit organization—the Association for the Advancement of Aging Research (AAAR). The AAAR recently forwarded a proposal to the Senate Special Committee on Aging, which the Senate Committee amplified into a Bill known as the Preliminary Gerontological Research Act. Senator Harrison Williams (D-N.J.) introduced this Bill (No. 3784) into

the Senate on July 15, 1968 but it apparently was introduced too late for consideration in 1968. (It will be re-introduced this year.) The core of the Bill is formation of an inexpensive ($5 million to $50 million a year) Aging Research Commission (ARC)—first suggested by Donald Carpenter in *Science*—which would have the authority to support fundamental biological research on aging, and be responsible only to the President and Congress. Despite some inadequacies in the proposed Bill, it is hoped that the ARC will gain enough popular support that Congress will soon pass the pertinent legislation.

Early Consideration of Aging

The foregoing has been realistically pessimistic about society's past support of aging research. Why has society taken such a negative attitude toward aging research? Well, in great part, this attitude has been formed by a subtle, insidious conditioning which developed as man progressed from Eden, through Athens and Rome, on his way to modern Megalopolis. This last statement is painfully verified by examination of a few pieces of historical data.

Over five thousand years ago a curious Sumerian legend was handed down from generation to generation, until the Babylonians finally inscribed on clay tablets their poetic version of this same legend —the epic of Gilgamesh, a man who vainly searched for eternal youth. Even though the hero, Gilgamesh, was able to perform many unbelievable superhuman feats during his adventures, the attainment of eternal youth remained forever beyond his reach. The moral of his epic is that "life or death" is a matter for the gods to decide; the decision does not rest with us mere mortals. Another example of man's futility against the power of the gods is Hesiod's tale of Prometheus. Prometheus's theft of fire for the benefit of mankind resulted in the creation of the first woman, Pandora, whose infamous box carried ills and evils, including aging, to man's world. Thus Hesiod traced old age and death to the will of the gods, and indicated the proper rolé of man as one of humility and submission.

Hesiod's five ages of man also implied that death was inevitable: he claimed that man had passed through a series of epochs and was presently in the fifth epoch, the bleak age of iron. The first period had been the happy age of gold in which man never grew old and in which death was gentle. Next came the age of silver when childhood lasted a thousand years. This was followed by the age of bronze when men were so strong and violent that they destroyed themselves. Fourth was an age of demigods who still live contentedly in the islands of the blessed at the

ends of the earth. Last was the fearful age of iron in which man was faced with unending work and misery. The future of the iron age was even worse for it includes a constant increase in strife, injustice and deceit; people would grow old more and more rapidly until even new-born babies would show the marks of old age. Implicit in this story was the belief that man could not stop, or even delay, his aging.

These myths and legends reflect man's attempts to explain that which seemed inevitable . . . and, by explaining it, to enable man to endure more stoically his own decline and death. But myths and legends did not encompass all of the exhortations which stemmed from the very human desire to avoid unnecessary emotional strain —the strain which would result from struggling against the "inevitable." The story of Adam and Eve tells of how God punished the first two mortals for their original sin: "In the sweat of your brow you shall eat bread, till you return to the ground, since out of it you were taken; for dust you are and unto dust you shall return" (Genesis 3:19). Thus old age and death were considered to be partial punishment for a terrible crime. The Old Testament taught that man should give due recognition to the limitations of human power, and that he should walk in the path of divine law in order to avoid further punishment. The New Testament stresses a different theme: the things of this world are of little importance and death is actually desirable since it is the way to salvation of the soul. Philosophers, too, attempted to assuage man's concern over remorseless aging and death. Aristotle explained death as the result of the inevitable clash between the "elements" composing the human body—a primitive "waste product" theory. On the other hand, the Epicurean concept of "fullness of pleasure" led Lucretius to believe that there are only a fixed number of earthly gratifications; once these have been experienced, further life is futile. Cicero and Marcus Aurelius emphasized the impotence of man and praised the virtues of patience and humility with respect to death.

The views discussed above form only a small portion of the history of man's subtle conditioning for submission to aging and death. When more of this history is examined, certain apologistic themes emerge:

1) Prolongevity, the significant extension of the life span by human action, is impossible because of defects in human nature;

2) Prolongevity is a violation of the natural order;

3) Prolongevity is a violation of the divine order;

4) Original sin prevents prolongevity;

5) Prolongevity is undesirable in itself, and

6) Old age and death are desirable.

An interesting point is the arguments supporting the above themes usually include a statement to the effect that prolongevity is impossible, and then give an apologistic reason for it being so. This has resulted in a considerable body of folklore and literature which predisposes succeeding generations toward believing prolongevity to be either impossible or highly undesirable. (One example of such is the story of Dr. Faustus.) This entire collection of apologistic reasoning forms an excellent example of a closed sociological cycle which tends both to provide peace of mind and to prevent progress—each theme is thus a self-fulfilling prophecy.

Fortunately there also are a few hopeful themes which appear in history. Man has often searched for that far distant place where humans have unusually long lives (Shangri-La), or for the remarkable substance with the ability to prolong life. The Greek legend of Hyper-Boreas ("beyond the north wind"—where people were free from all natural ills and lived a thousand years) was easily sustained as long as transportation and communication remained difficult. The same theme, which promises a veritable paradise of healthy longevity on Earth, appears in folklore from Japan, India, Persia, Greece, England and other countries. These legends about terrestrial paradises long served as stimuli to geographical exploration, as did the impassioned searches for the Holy Grail and the Fountain of Youth. The mystic golden Grail beckoned adventurers with its promise of everlasting life to the finder—Hesiod's "age of gold" concept. Likewise, legend ascribes the discovery of Florida by the elderly Ponce de Leon to mere serendipity resulting from his search for magical waters that could transform the aged into youths. In many cultures other similar objects and substances are referred to, some with divine properties, some with magical qualities, and others with supposedly empirical characteristics that were thought to unexplainably suspend human aging.

The classic theories of Taoism stimulated a large proportion of the semi-scientific study in ancient China by propounding the concept of *hsien*: man could win eternal life on Earth by means of his mastery of the techniques of prolongevity. There were prescribed respiratory, dietary and spiritual techniques but the most interesting were sexual techniques—in particular the practice of coitus reservatus while one's partner was having a climax. It was thought that he who could carry out this act several tens of times in a single day and night could be cured of all

maladies and have his life extended. If he changed his partner several times, the advantage was greater; if in one night he changed his partner ten times, that was supremely excellent. In perspective, Taoism and its concommitant emphasis on examining and controlling bodily functions took prolongevitism from the realm of magic and changed it into a protoscience.

Alchemy represents the first systematic prolongevitism to appear in Western civilization. The attempts of alchemists to transmute ordinary metals into gold—stimulated by Hesiod's first age of man as well as the economic benefits—and to prepare chemicals which would prolong life contributed techniques and materials to early chemistry. But more so, the suspected relation between long life and potable—safely drinkable—gold stimulated much of the alchemists research, and thus gave man a rational basis for hoping that something could be done to alleviate or avoid the undesirable effects of aging. This, with the other themes of man's rebellion against the creeping decays of age, has spurred men to search throughout the world for the mysterious land of the eternally young, or to drink noxious potions concocted by alchemists and witches, or to strive to attain a state of extreme penance akin to the ecstasy of Tibetan monks, or—through drinking blood—to steal youth in the best tradition of vampires. Present, less repulsive, efforts are being carried out in laboratories around the world.

Final Comments

In the past, there was no advantage to a long life span; indeed, there was a definite advantage to a short life span and early production of offspring. (A short generation-reproduction cycle enables more rapid adaption of the species to a changed environment.) If that environmental situation still held true, prolongevity would be in direct conflict with the requirement for early reproduction. However, we now have the capability to control our individual environments—heat, cold, humidity and hopefully pollution—to suit our needs; thus, rapid adaptation of mankind to a changing environment is no longer necessary. This means that early production of offspring is no longer necessary, and prolongevity is no longer in conflict with hereditary needs. Furthermore, an increased life span offers mankind the twin hopes of social stability and more rapid economic advancement. If such a guaranteed increase is to occur, however, it must be consciously sought by man; we must theoretically and experimentally deduce the causes and corrections for biological aging. This could well involve development of numerous processes for: 1) removing various types of crosslinked material; 2)

removing non-functioning body cells and intercellular material; 3) replacing missing nerve, muscle and other cells; 4) correcting mutated molecules; 5) chemical coding and/or re-coding of genetic material. It has even been suggested by Leonard Hayflick that biological death might be the result of cellular programming, implying that extension of life span would involve *extensive* cellular re-programming, but this "Programmed Death" theory is not in good agreement with the known facts. The basic point to be gained from the foregoing is that you can anticipate extension of life span to be achieved in a series of varying-sized steps . . . one step for each laboratory success. The more that research is encouraged, and the better organized the effort, the more rapidly those steps will be achieved.

Does this mean that eventually individuals can anticipate living forever? Absolutely not! Even if biological aging was completely eliminated, the average life span would be less than a thousand years; accident, disease and overt action—wars, et cetera—would still limit individual life spans. Would such an increase in life span conflict with religious teachings? Again the answer is no. It would not confiict with religion any more than has the medicaNy-induced doubling which has occurred in the American and European average life span since the start of the last century.

Another supposed problem has been suggested but it bears the hidden touch of apologism. Wouldn't an increased life span be fraught with boredom, and wouldn't individuals long for release in death? Such suggestions fail to take account of the increasing rate of change in our world, and they bear the indelible imprint of Lucretius's concept that life holds only a fixed number of gratifications. Again, the apologistic themes in our culture have formed a trap.

There is a problem of greater concern though—one which is more stifling to aging research than the apologistic themes themselves. This is the proper concern, realistically motivated, that the world will shortly be over-populated. Many fear that research on biological aging will sharply decrease the death rate, thus drastically aggravating the over-population problem. The immediate confrontation between present attempts to solve the population problem and attempts to extend the human life span is merely illusory though. The present birth rate exceeds the death rate by such a great amount that the population problem will have to be solved long before prolongevity can contribute significantly to the population size. In other words, the population is growing at such an extreme rate that an acceptable birth control solution must be found and applied in the immediate future whereas, even if successful techniques of

prolongevity were discovered this year, the additional population increase from this discovery would not be significant for some time to come.

Suggestions that prolongevity should be avoided in order not to aggravate the population problem are akin to that obnoxious nostrum which proposes to solve the problem by increasing the death rate (for instance, by ceasing all research on more efficient agricultural methods—last year 60 million people died, and over two-thirds of these deaths were associated with hunger). Related proposals, for postponing aging research until a "better life" can be provided for those now living, also demonstrates a superficial—and certainly ignorant—attitude.

Let us consider a more positive aspect of prolongevity. We all know that conservation is necessary if we wish to bequeath future man something other than a garbage-heap planet with exhausted resources. But it is difficult to convince people that conservation requires action by each and every individual. This message would be easier to sell if individuals anticipated being around to benefit in the future from their actions in the present. Another benefit which would result from prolongevity is the possibility of travel to other stars in our galaxy. Such travel is now believed to require centuries or millennia for other than the few nearby stars. With an increase in life span, these long trips would become possible without the crew being replaced by their descendants during the trip. Prolongevity will not only vastly improve life on Earth but it will also open the way to the stars and exciting new adventures.

In conclusion, then, the average human life span has been steadily increasing but the maximum life span has demonstrated a notable lack of change. However, the capability to alter this situation is now within our grasp. Will we have the foresight and courage to extend that grasp? The title question of this article was: "Is biological aging inevitable?" Perhaps the final answer is: "Only if you choose it to be."

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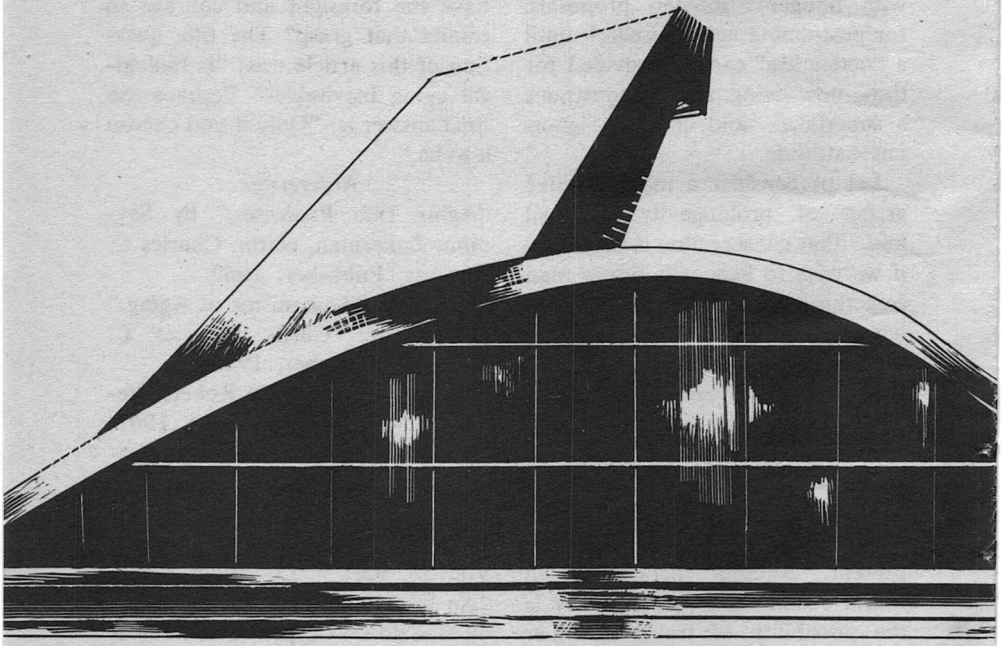
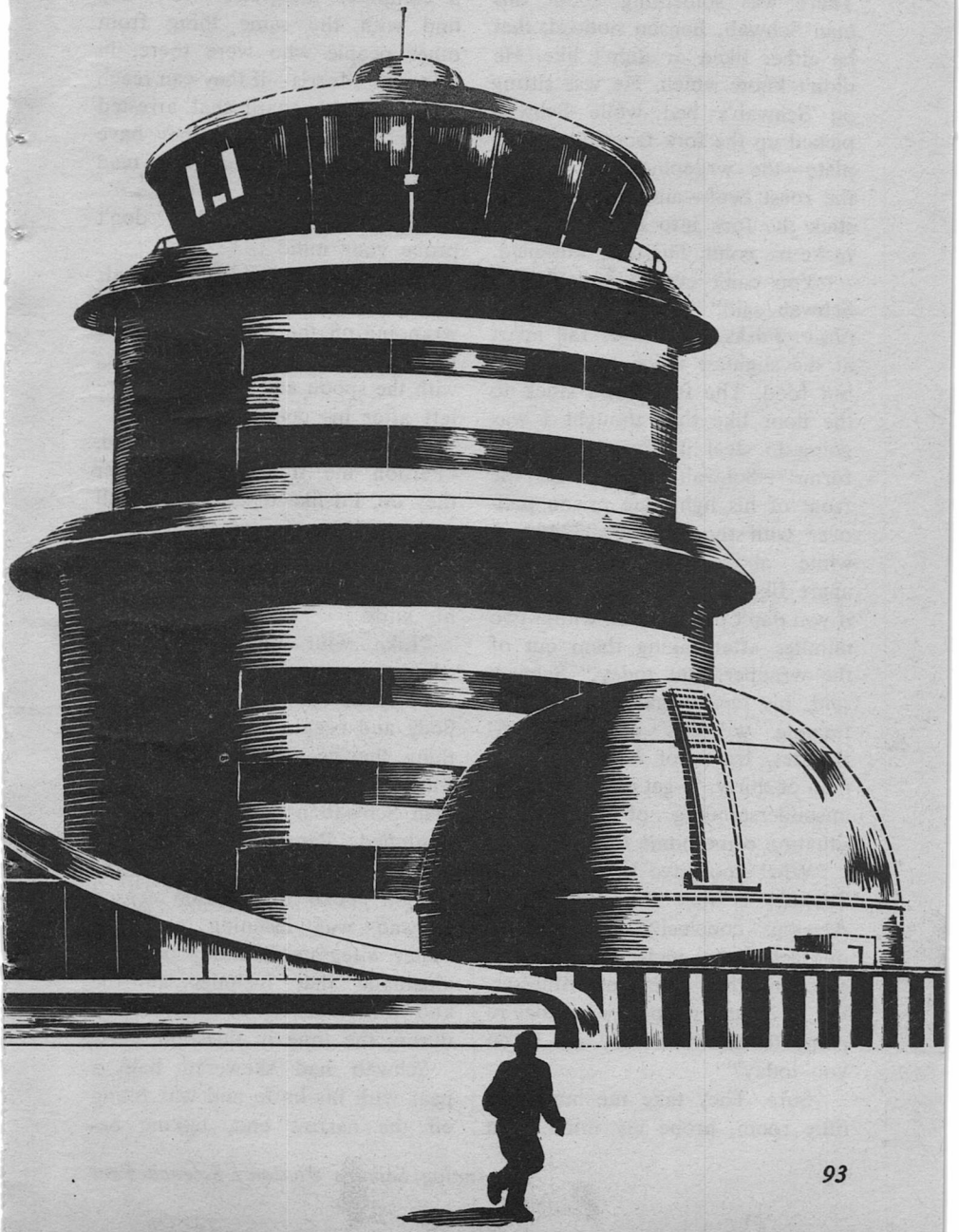
mindwipe

It is not necessarily true that a telepath is smart, and under some conditions he might not know what he was doing—but he'd sure need a smart defense lawyer to figure it out without telepathy!

TAK HALLUS

Illustrated by Vincent diFate





There was something about this man Schwab, Benson noticed, that he either liked or didn't like. He didn't know which. He was sitting on Schwab's bed while Schwab picked up the fork from his dinner plate—the wrapping still covered the roast beef—and was trying to stick the fork into his forearm to make his point. The fork crumbled.

"You can't even kill yourself," Schwab said, "to get out of this place. Forks and knives fall apart at the slightest touch on anything but food. The furniture's stuck to the floor like they thought I was going to steal it. Even these uniforms"—Schwab pulled at the front of his light-blue prison pullover with the number "7246" in white above the pocket—"fall apart like mildewed potato sacks if you don't put them on within two minutes after taking them out of the wrapper. But today," Schwab said, his face bright and his eyes fanning wrinkles out over his freckles, traces of boyhood on a man of thirty, "I get out." Schwab's misunderstanding of the whole situation came home to Benson.

"What you have to understand, Schwab, is that the kineticorder develops conclusive presumptions of fact more incriminatingly on occasion than even eyewitnesses. Do you understand what they're going to do when they use it on you today?"

"Sure. They take me into their little room, probe my mind, then a computer integrates what they find with the same thing from other people who were there, in this case, Morris—if they can reach him—and the guard that arrested me and any other data they have about the surroundings. I've read about how the thing works."

"That's right, but they don't probe your mind."

Schwab sat down on the chair facing his dinner and pulled the wrapping off the plate. Steam rose from the meal as he began eating with the spoon and knife that were left after his demonstration.

"So what do they do?" he said. "Pardon me if I eat. Whatever they do, I'd like to do it on a full stomach." He smiled briefly and held down a piece of roast beef with his spoon while he cut it with his knife.

"Like your mind remembers, whether you remember consciously or not, the cells of your body and organs remember everything they've ever done." Benson watched Schwab eat. For a thin man Schwab had an appetite that reminded Benson of his own paunch. He ate continuously as Benson spoke but Benson sensed Schwab was listening carefully. "They integrate it and produce a videotape that includes all the known information of your actions during the time in question."

Schwab had skewered half a pear with his knife and was biting off the narrow end, talking be-

tween his teeth as he ate. "Isn't that all circumstantial evidence?"

"Yes," said Benson, watching Schwab finish the pear and dig his spoon into a steaming pile of baked beans. "But as the saying goes, which piece of evidence would you take: the word of a hundred eyewitnesses that no dog had passed by or the dog tracks in the dirt? In your case you were only on Paria a day. You had never been there before. The environment's controlled in the Concession and man-made. They'll get a very good tape."

Schwab put the knife and spoon down on the empty plate and stripped the top from a glass of milk. He lowered the empty glass and wrinkles again surrounded his eyes, this time from a pensive squint. "You mean they don't take a mind probe at all?"

"No."

"Isn't that unconstitutional or something? Self-incrimination? That disk they gave me on Paria when I was arrested says I have the right to remain silent." Schwab's voice was beginning to sound angry, the response Benson had expected originally.

"Your cells," Benson said, "or so goes the argument that upheld the use of the kineticorder in the court of last resort, can't incriminate you any more than the objective fact of your fingerprints, or your blood, or your face in a lineup for that matter."

None of Schwab's earlier goodwill was left in his face.

"I don't want to argue all the fine legal distinctions with you, Benson, but I won't do it."

Benson tried to keep the thought that Schwab was charged with criminal telepathy neatly filed in his mind with the other legal information about Schwab, but the thought that Schwab was a telepath, criminal or otherwise, intruded. Even Schwab, if what he claimed was true, had only learned it recently and Schwab's resentment at being forced to give kineticorder testimony was the emotion of any of the men Benson had seen in similar cells. But Schwab's reason for resentment—that it didn't probe your mind—was unique.

"I'm afraid you'll have to, Schwab. They have a court order and can force you if you won't go voluntarily."

"Can I get them to use a mind probe if I volunteer for it?"

"I've told you, there isn't any such thing. There's just the kineticorder. They developed something like you're describing a few years before the kineticorder, but quit using it after the first case. With a mind probe it *is* self-incrimination. Taking a reading off a man's body is one thing, off his mind is another."

"So what happens if I want to incriminate myself?"

"You can do that, of course, but that's why I'm here."

"Look, Benson, if they could read my memory or something like that, they'd know I didn't do it intentionally. When I was standing outside that office, something just came over me. I looked into Morris's office and I knew it was Morris. I don't know how I knew. But I did. And I had to see him about something. It was like one of those dreams where you have a perfectly good reason for doing whatever you're doing but you just can't put your finger on it. I went into his office. I stood over him. Then my mind, or my thoughts, or something like that, were reaching out to him and touching his mind. I don't know what it was. I don't know."

Schwab's hand was tense around the milk glass. As he sat, looking past Benson's eyes, the milk glass crumbled.

"If they could read my memory, they would know that," he continued without noticing the glass. "But, if all they read is my body, I haven't got a chance. I was there. The guards saw me there. You don't need a computer to prove that. The guards kept me from falling down. I'd lost my bearings so completely they could have told me I was on Earth and I would have believed it. I'd heard of mindwipes and I knew I'd just done one, but how, Benson, how did I do it?"

Schwab dropped the crumbled piece of plastic on the table. He looked over to Benson. A soft smile had returned to his face as he wiped the last, clinging pieces of the glass from his hand onto his uniform.

"If I confess to that, will my confession be to their computer tape the same thing your hundred eyewitnesses were to the dog track? Probably." He shook his head slightly. "Probably."

The smile showed Benson that Schwab was adjusting to the idea of giving the testimony. It would make things easier for both of them.

"You're probably right about the kineticorder. Is there anything else you can remember that might help us with your defense? Anything you haven't mentioned."

"There isn't any defense."

"That's my job." Benson thought for a moment Schwab's stubborn attitude might emerge again but he recognized in the way Schwab answered that it was merely a disheartened opinion and not resistance. "Yours is just to tell me everything you can about it."

"I told you about Morris. I told you about Paria. I told you about Regina. I've told you about everything, haven't I?"

"Who's Regina?" Benson asked, answering Schwab's question at the same time he asked his own.

"I don't know. It just occurred to me, going through the whole

thing again. After I'd done that thing to Governor Morris . . . when he didn't exist anymore . . . my head was filled with a name, Regina, like someone was screaming at me."

"That's all?"

"Yes. I don't know what it means. I don't know anyone named Regina. Until just now I thought it was part of Morris's mind but it couldn't have been because Morris was gone by then. I don't know what good it will do you." Schwab lowered his eyes to Benson's. "Or me."

Benson decided, as he sat on the cell bed that the something about Schwab was something he liked.

"I think it's time to go, Schwab. They schedule these things pretty tight."

II

Benson could see the same three groups were in the waiting room of the kineticorder section that were always there, attorneys, prisoners and guards. The last group predominated but Benson's attention was on a member of the first.

"That," he said to Schwab who sat between Benson and a guard and looked toward the gray-haired man in his late sixties whom Benson indicated standing next to a door marked Authorized Personnel Only, "is McMasters. He's handling your case for the prosecution."

While Schwab answered he watched McMasters lean against the wall next to the door and partially cover a plaque on the wall. "What will you be doing while I'm getting probed?"

Benson looked at Schwab with irritation.

"They don't call it 'getting probed.' They call it taking a reading. And I'll be in the Discovery Room with McMasters having a sneak preview of what the jury will see. McMasters will try to get as much as he can left on the tape and I'll try to get as much as I can thrown out and somewhere out of that will come what the jury eventually sees as a reconstruction of what happened. Then in a separate editing session, we'll each go over the notarized tapes of other witnesses and anything else that's pertinent and the whole thing will be shown to a jury minus any histrionic and objectionable garbage either of us try to stick in and they'll decide what they saw. And that's about it."

Schwab smiled again and said, "Yes, that's about it. What's that sign he's leaning on?"

The Authorized Personnel Only door had opened next to McMasters and a man with the sleeves of his sweater pushed up on his forearms and his collar unsnapped shuffled through papers on a clipboard.

"It's the motto of the place. *Veritas Nihil Veretur Nisi*

Abscondi: the truth fears nothing but being hidden. Half the time I'm here I think it should be the truth is afraid and in hiding."

The man at the door flipped through his papers and found the sheet he wanted. "Schwab, Ernest. Seven-two-four-six. This way, please."

"Benson," said McMasters as they sat in the Discovery Room at the matched consoles for prosecution and defense, the screens still blank in front of them as Schwab was being prepared for the kineticorder, "you're looking a little ill."

"Just a cold," answered Benson. Editing a kineticorder tape was always the hardest part of a trial for Benson. He had to keep in mind his client's explanation of what happened, the legal overtones of the entire situation, what the other side would try to make out of it and what their probable point of attack would be and at the same time watch the screen with some sensitivity to how the events he saw related to his other considerations. McMasters had the same considerations and presumably thought if he was able to rattle Benson before the editing began, no matter how slightly, it would be an advantage, but Benson had expected it to come somewhat after McMasters's opening words.

"It looks like a little more than that to me, Benson. Do you want to postpone this reading until you're in a little better shape?"

Benson looked up from the green glowing Objection plate he had been idly examining to avoid conversation with McMasters. "I'm just fine. I'll worry about my health and you worry about your case. We want the state to have the best possible chance in this matter."

"I can't think of a better way to work things, Ben. You take care of your business and I'll take care of mine, but, of course, we still have this fellow Schwab to worry about together."

"Save your rapier for your clerks, Mac, and let's try to make this thing run as smoothly as possible." Benson was immediately dissatisfied with himself. He should have ignored McMasters and let him have his fun. McMasters would have run down by himself if Benson had let the conversation die at the beginning.

"All right, Benson." At least McMasters seemed to have got the point about his name. "Personal comments are out of line here. But tell me about this fellow Schwab. A criminal telepath. That interests me. I'm sure you know the history of the legislation as well as I do . . ."

Benson had thought for a moment that McMasters had given up but he could see now that the condescending tone McMasters was taking indicated he had only changed his point of attack. Ad-

mitting that Benson knew the history of the legislation as well as McMasters, McMasters was going to go right ahead and explain it anyway, in case, said the inferrence in McMaster's tone, Benson had failed to do his homework.

". . . But it has always seemed to me, when I thought about this particular crime, that it reflected, as well as any example, the law's adaptability to new times and new circumstances. The population grows and although these fellows, telepaths, occur only about once in half a billion, the population of the Federation has become large enough so that a few of them are criminals and the law responds. 'Criminal Telepathy,' " McMasters said, quoting the Penal Code, the latest revision of which he had helped write, " 'the willful and malicious application of psionic force to the mind of another.' You won't find anything like that in the old Common Law, Benson, but you do find that genius of adaptability that allows new crimes in new times."

Benson saw McMasters was proud of his last twist of diction. He also saw a way of finishing off the conversation since McMasters showed no inclination to do so.

"On the contrary, McMasters, the ancient law did have such a crime. They, of course, called it by a name more reflective of their times."

Benson noticed a trace of what almost looked like genuine curiosity on McMaster's brown, wrinkled face.

"Oh. And just what did they call it?"

"Witchcraft."

The yellow ready light on the consoles came on before McMasters could answer. Benson showed none of the relief he felt. He turned to the screen on which vague shapes were moving and twisting as the computer zeroed in on those few hours Schwab was on Paria. Benson had to keep his mind clear and concentrate.

"Ah, ha," said McMasters on Benson's right as the picture finally integrated on the screen, "there's our man now."

McMasters didn't miss a distraction, thought Benson, and settled down to watch with his hand over the glowing Objection plate. He would try to fill in the gaps in what he saw with what Schwab had told him.

Benson could see it was raining on Paria. Schwab sat in a chair in the Concession's single hotel with his weight shifted onto his left hip and his chin cupped in his palm, looking out the window. The rain outside was like dirty water and the warehouse across the street from the hotel looked dull and drab. Even the elms that tried to make the human Concession more like Earth were faded green. Benson tried to adjust the screen.

The console responded with a

superimposed answer at the bottom of the screen. "Adjustment Correct."

"It's the sunlight, Benson," said McMasters, looking at his own screen. "An F spectra star, everything looks dull in that light."

Benson admitted that McMasters had been doing his homework and returned to watching the screen. Out the window Schwab could see the Parian mounds and as the rain stopped and the dingy sun steamed the flatland between the mounds, Schwab saw the Parians working around the mouths of the mounds. The gray creatures with their forehands able to form natural scoops had covered half the warmbelt continent of Paria with their network, Benson knew, and they probably wondered in their primitive way what the Earthmen wanted with the dirt that was a by-product of their tunneling. Pyraclore ore for the niobium and tantalum industries on Earth, thought Benson, and somebody else did the work of getting it out in exchange for tools designed on Earth so the Parians could more efficiently dig more pyraclore. A one-sided trade but profitable if you were on the right side of it.

On the screen Schwab stood up and walked back and forth in the room. He looked around the room as if he expected to find someone else there.

"Objection!" shouted McMasters and slammed his hand down on the plate in front of him. The screen went blank and a small yellow light on Benson's console lit up echoing McMasters by reading *Objection.*

"To what? All he did was stand up!" shouted Benson in return but he could see McMasters was not going to be led into any kind of admission about his tactics by this ploy.

"This whole business," said McMasters, "of our man standing around there doing nothing is immaterial, irrelevant and entirely beside the point! It goes!"

"It stays!" said Benson with equal force.

It was significant that McMasters only objected when Schwab got up and looked around. Schwab had said that at that moment he had felt like someone was watching him. "It was the feeling you get in a crowd sometimes," Schwab had said in the cell, "when you know somebody's watching you from across the street and you want to go over and ask them why they're watching but you can't make out who in the crowd it is." In Schwab's case, as Benson and McMasters had just seen, there had been no crowd, just Schwab, alone in the room. How much did McMasters know of Schwab and how much was he guessing? Or was he just testing Benson, again, to see what kind of a fight Benson would put up for

an apparently insignificant event, a man standing up?

"Now, look, McMasters, we're going to be here all day if you keep jumping on every blink of an eye and objecting. Can't we at least get one run through before you start snorting?"

"All right. All right," said McMasters, shaking his gray head as if perplexed by the unlawyerlike attitude of his colleague, "If you want to just sit here like we're out for an afternoon's entertainment, that's all right with me, but a timely objection now will save us more time later. We won't have to go over it a dozen times."

McMasters pushed the Objection release, the computer noted the objection for future possible editing and the screen came back to life.

Schwab paced the hotel room, occasionally glancing out the window, then he walked toward the door. Benson knew Schwab had decided to seek out the hotel's bar, thinking a few stiff ones might get rid of his malaise, his feeling of being watched. Schwab came out into the hall in front of his room and looked down it toward a half open door.

"Ah," said McMasters quietly, "Now we're getting somewhere."

Schwab walked down the hall and stood in front of the half open door. The Concession was small and many of its administrative offices were located in the hotel. Benson could see a man inside a room that was one of the offices by the books lining the walls and folders open on top of the desk. The man lay on the couch with his arm over his forehead and eyes closed. The screen went blank without the Objection light coming on. Benson looked over at McMasters who was pressing the Hold plate.

"That, Brother Benson," said McMasters, "is Jeremy Morris. And in *his* case, youth was a decided advantage. Do you know that man's background?" Benson knew it perfectly well but he let McMasters continue. It would be quicker to let him have his say about the poor victim—a speech he must use at least twice a week—than to argue about getting back to the tape. "Jeremy Morris, New Harvard class of '09, New Harvard Law class of '12, representative from the planet of Pylos Four to the Federation on Earth at age twenty-eight and Governor of the Parian Concession under special directive of Federation President Stacy at thirty. In short, a brilliant man and this telepath" —McMasters seemed to spit the word out—"you're defending mindwiped him down to a fetus. The people on your side of the court never consider the poor victim. I hope they give this man Schwab the whole Rehab treatment."

"I don't want to remind you of this, McMasters," Benson said, "but we haven't seen him do anything yet."

McMasters took his finger off the Hold button and the screen filled with the interior of Governor Morris's office. Schwab walked over to Morris and bent as if he were going to speak to him, then paused. A blank look came onto Schwab's face for about thirty seconds and he stood erect again.

"That," said McMasters, "was when he did it."

Schwab seemed to waver a moment as if he were about to collapse, then two Concession guards rushed in, their kineticorder testimony integrated as Schwab's was now being integrated. Benson remembered Schwab talking about that moment that only showed on the kineticorder as a blank expression. Schwab had felt his mind touch Morris's and in that instant in his own mind were the memories of Morris's past, reaching, probing into every corner of Morris's private thoughts, pushing back through the years of college, elementary school, the earliest moments of childhood, perhaps even with Morris in his mother's womb, until there was no more. "I don't know what it was. I don't know," Schwab had said and then when there was no more Jeremy Morris, Schwab's head was filled with a name—REGINA.

"I don't think we need much more," said McMasters, "for a conviction. You may concede at any time. Someone will contact me in the event you actually want to do such a thing." McMasters looked at Benson and Benson thought for a moment McMasters was not acting, not being the lawyer, when he said, "But I don't suppose you'd want to do that. You'll carry the whole thing through."

McMasters got up and put the few papers he had spread around the table of the console into his briefcase.

"I'm paid to carry the whole thing through. Aren't you going to watch the arrest?"

"I don't think it will be necessary. I'll have my version of the tape sent over to you and after I look at yours, I'm sure we'll have a little talk. Good afternoon, Benson." McMasters walked to the door of the Discovery Room and out.

Benson turned his attention back to the screen. He could see that the ground outside the Concession was now completely dry. A line on the ground about a hundred yards from the beginning of the Parian mounds separated them from the Concession at a point where the static field kept the Parian dirt from blowing through the Concession streets. Dust devils were swirling against the static field like powdery beasts trying to butt their way into the Earthmen's sanctuary. Benson looked back to

Schwab's image, then pushed the Hold plate and spoke into the intercom that connected him with the kineticorder.

"This is Benson," he said to the computer. "Please take a reading through the arrest and have the tapes sent to my office. Thank you."

He could go over the last few minutes of the tape tonight, he thought. With McMasters gone, Benson could see the tape wasn't going to be finished today anyway but would come out of some compromise negotiation between their offices. Besides, his cold was bothering him more and he had a headache. He couldn't see anything for Schwab at this point but a conviction.

III

On the walk back from the kineticorder section the guards had acted like Schwab was a vial of nitroglycerin and they wanted to deliver him as quickly and carefully as possible without jarring him. They had been tense and effusively pleasant at the same time. Schwab would have to ask Benson, who sat in front of him again in the cell, if he knew why, after he asked a more important question to which he already knew the answer. Benson looked more washed out than he had two weeks ago when they had first met.

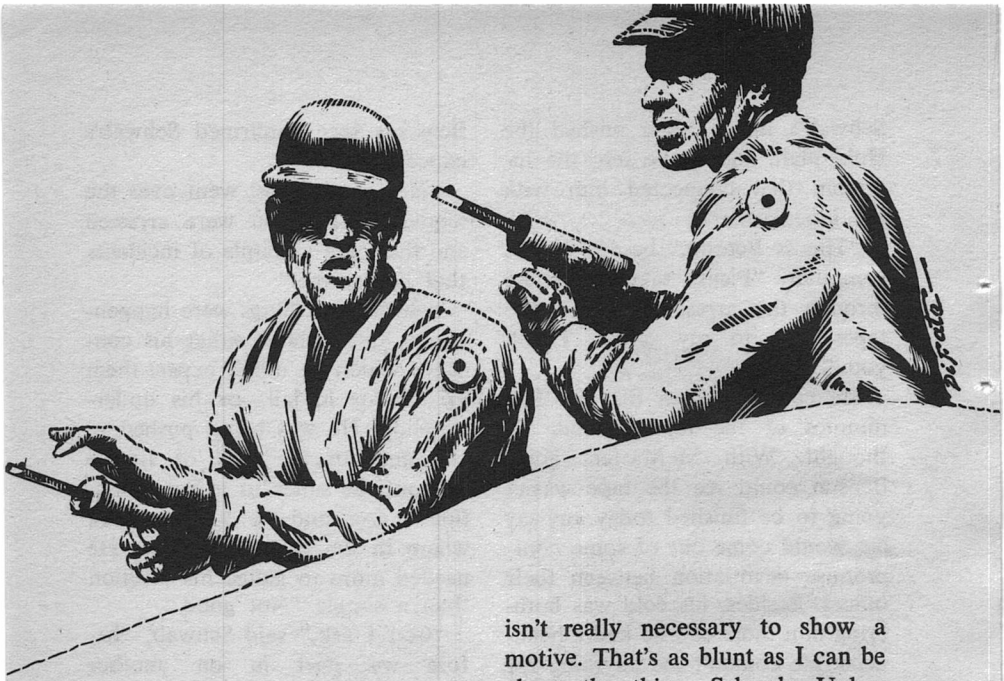
"What does the tape look like?" Benson's face confirmed Schwab's expectation.

"Not good. I just went over the sequence when you were arrested and there are a couple of incidents that bother me."

Schwab felt things were happening to him without either his consent—which he didn't expect them to ask for in jail—or his understanding. He was being pushed in one door of the Hall of Justice and out the other to a Rehabilitation center and he had no idea where in the process he was. He needed more to gauge his position than a simple "Not good."

"Can I ask," said Schwab, "before we start in on another round of your questions, what they have on me? I've been going over the whole thing again and again and I don't feel guilty. I've asked myself if I did what they say I did and every time I answer yes and at the same time I answer no. I mindwiped Governor Morris. I wouldn't do it again and I wouldn't have done it then if I could have helped it and I don't feel guilty at all. How can they convict me on that? I didn't have any reason to do it. I didn't even know Morris."

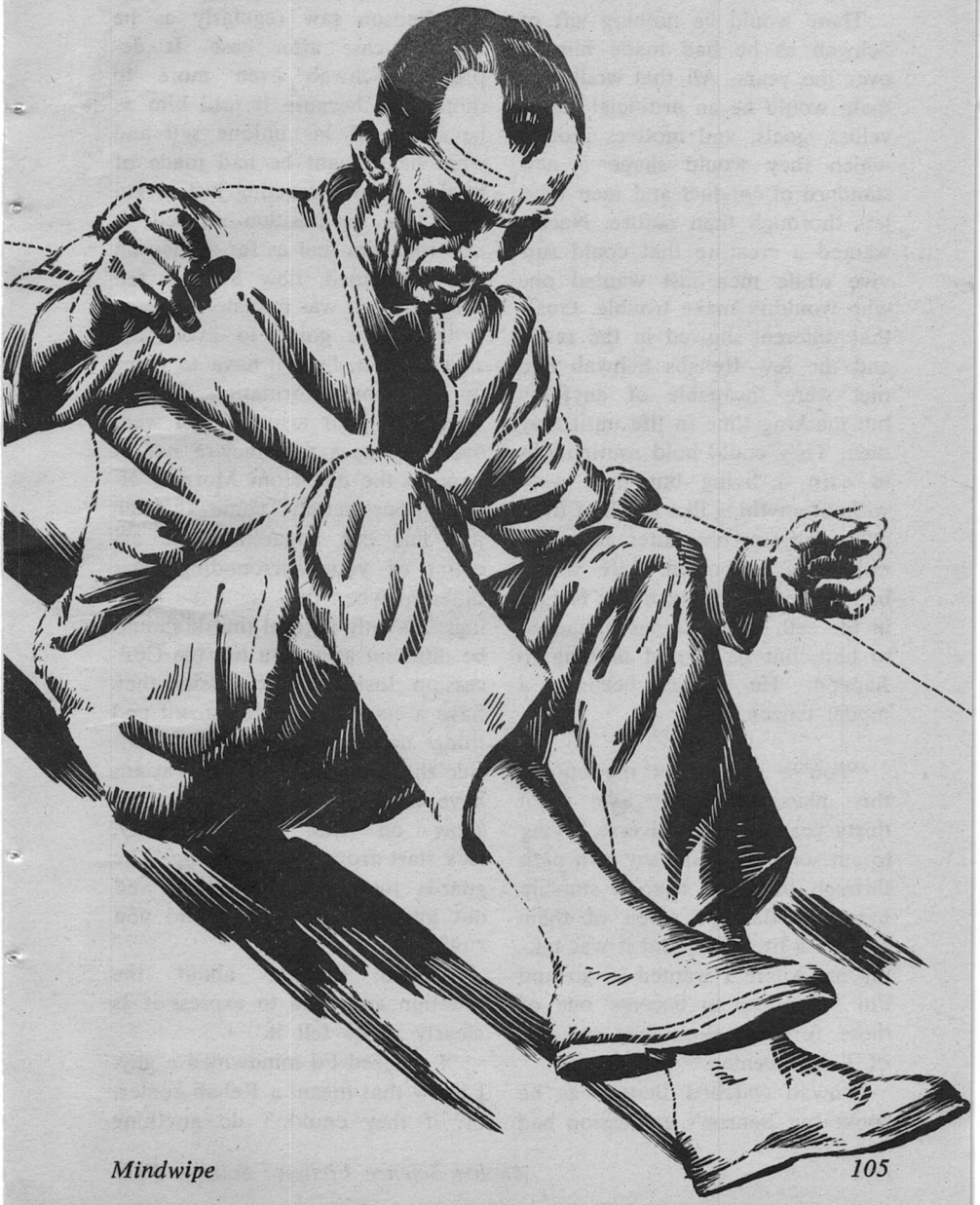
Schwab could see Benson was sympathetic but in the back of his mind he wondered if this was real sympathy or only a professional face Benson put on with his clients. Schwab asked himself if Benson was interested in him person-



ally and his fate or just the fate of the legal Schwab, the criminal telepath. Schwab shivered momentarily.

"What they've got on you," Benson answered, his voice rough and nasal through his cold, "is simple logic. Jeremy Morris was mindwiped; you were with him when it happened, *ergo* you're it. They don't care how you feel. They are the ones who judge whether you *are* guilty and they don't particularly care about your motive. Assassination and euthanasia are both murder, and motive might be helpful to show a desire to bring about the result of somebody's death—I suppose you can call a mindwipe death—but with modern techniques, like the kineticorder, it isn't really necessary to show a motive. That's as blunt as I can be about the thing, Schwab. Unless we can come up with something else, as I said before, you're it."

He was it but what was contained in that "it"? Benson had explained it all before and now the force of it came back to Schwab as an immediate prediction of his future that had a high probability of coming true. He would be sent to a Rehabilitation center, either here on Earth or somewhere, and they would do to him with technology what they said he had done to Morris. They would mindwipe him. Not because of some primitive sense of vengeance like an eye for an eye, nor from any sense of irony, although Schwab recognized that some people would think it ironic that a criminal telepath should be mind-



wiped, but as the standard procedure for severe antisocials.

There would be nothing left of Schwab as he had made himself over the years. All that would remain would be an aritificial set of values, goals, and motives around which they would shape a new standard of conduct and men were less thorough than nature. Nature wanted a creature that could survive while men just wanted one who wouldn't make trouble. Goals that different showed in the result and the few Rehabs Schwab had met were incapable of anything but marking time in life until they died. They could hold routine jobs to earn a living but they were without anything like a will of their own. Self-assertion after Rehabilitation was unknown. Life would be like the one Schwab was feeling in the cell, where things happened to him, but he caused nothing to happen. He would become a model citizen.

"You've got to get me out of this place, Benson! I've spent thirty years in this universe, trying to cut something like my own path through life. I've been a starship hand for the last seven of them and it's a life I like and it was taking me where I wanted to go and I'm not going to become one of those formless slugs they put out of Rehab centers!"

Schwab watched Benson as he spoke but Benson's expression had remained the same. Schwab realized his own reaction must be one that Benson saw regularly as he handled case after case. It depressed Schwab even more to think this, because it told him as he spoke of his unique self and what he thought he had made of it, that he was reacting just as everyone in his position reacted. It also told him that as far as Benson was concerned, how Schwab felt about himself was immaterial.

"If you're going to avoid it," said Benson, "you'll have to come up with some information. We can start with your arrest. I just went over the tapes and they're not as good as the one from Morris's office. Your actions come through just fine but apparently the account of your surroundings was different when they took the readings. It's only natural that it should be different after you left the Concession. Inside the Concession they have a controlled environment and things don't change much but outside the elements and the Parians have their say and those changes show on the tape. Anyway, let's start from the beginning. The guards took you downstairs and out into the street. Why did you run?"

Schwab thought about the question and tried to express it as clearly as he felt it.

"I realized I'd mindwiped a guy. I knew that meant a Rehab center, or, if they couldn't do anything

with me, a penal planet. I wasn't thinking too clearly. I just ran."

Schwab remembered running down the long, Concession street, expecting somehow to be stopped. He remembered the feel of the hot air against his face as he went through the static field outside the Concession and the dust coming up into his eyes and sticking to his skin. He remembered spotting a mound with no Parians around it and running to it, then scrambling up the side, slipping in the loose dirt, and looking back from the top of the mound. One of his guards was loping after him. He remembered the feel of the dirt scraping against him as he slid down the forty-foot cone into the mound. He remembered his eyes adjusting to the dim light in the hole as he began to make out spots of light in each of the receding tunnels where other mounds surfaced at intervals in the passages.

"Once I got inside, I didn't know where I was going. I didn't have any plan. I was thinking on the level of a child. I just wanted to be alone and think out what I had done. I still haven't thought that out." Schwab paused and looked at Benson who was listening carefully to what Schwab said. "I don't know if there *is* anything to think out. Maybe I just did it and can't control it and they should wipe me out if that would keep it from happening to someone else. Should they do that to me, Benson?"

Schwab saw a flicker of something in Benson's face. It was so indistinct Schwab was unable to interpret it, but he could tell that whatever it was Benson had controlled it and his professional face was still intact.

"I don't know what they should do, Schwab. Just tell me what happened next."

Schwab remembered running through the gray tunnels, making random choices when a tunnel forked. Finally, when he could run no more, he stopped, panting and leaned on his knees to catch his breath and squatted in the tunnel. When his breath stopped rasping in his ears and his heart slowed, he heard the first scraping sounds. He knew what was causing the noises. The Parians knew someone was in their tunnels. He couldn't tell which way the noises were coming from, but they were getting louder. He stood up and listened.

Schwab remembered the feeling of bewilderment he had known at the time. He hadn't known whether to stay where he was or run again. He hadn't known what the Parians would do if they caught him. He started back into the tunnel he had come from, but the noise seemed louder as he entered so he turned around and tried to choose from the other

four. The intersection he was in was under an air-and-light vent hole and some of the dull sunlight fell down on him. He remembered looking at his clothes. They were frosted with dust. He ran his hand over his forehead and felt the dirt and sweat. The saliva in his mouth tasted thick and dirty.

"I just wanted someone to come and take me out. That was a horrible place, Benson. I've never felt so confused in my life."

Schwab had heard the scraping noises getting louder and could smell a rancid odor rising in the tunnels. They were nearer and he had to choose a tunnel.

"Then I saw that footprint and any simple-minded hope I had of getting out of the place died. If I didn't recognize a place I had been by before, there was no hope of getting out. I just stood there."

"I wondered what you were looking at," said Benson. "It didn't show on the tape."

"The scraping got louder and nearer. I looked up from the footprint and the first of those rat-bodied creatures was coming out of one of the tunnels, then one from each of the tunnels. I backed against the wall of the tunnel with no thoughts, just waiting to see what was going to happen."

"That's when Officer Daniels showed up" said Benson.

"Is that his name? Yes. I heard him call my name. I thought at first it was one of the Parians. I guess they can communicate with each other. But it was the officer. 'There you are,' he said as if he'd been waiting all afternoon for me and he handed me this thing." Schwab held up a Miranda disk for Benson to see. "He told me I was under arrest and that this disk would explain my rights, which it did, I guess. I pressed it and I remember something about my right to remain silent, but at that point I couldn't even think, much less speak. The officer pointed at the tunnel he had come out of and I followed him and the Parians followed both of us. I guess they were helping him."

Schwab looked at Benson, trying to determine what impression all that he had said made on him. Only Benson's cold was evident in his face.

"That doesn't help much, does it?" Benson said and stood up, preparing to leave. "Unless you have some questions, I'll leave you to your sleep."

"There was one thing. When the guards brought me back here this afternoon they acted like I was a time bomb that hadn't been defused. Do you have any idea why?"

Benson's professional face was gone and puzzlement replaced it. Then Schwab could see that Benson had an idea that amused him. Benson smiled, then burst out laughing.

"Why, Schwab, they're afraid of

you. You're a criminal telepath as far as they're concerned and they must have heard from the technicians what was on the tape. They don't know what you'll do. You might even mindwipe them!"

Benson's laugh trailed off. "Excuse me for laughing. They just don't know you as well as I do. Keep 'em guessing, Schwab, it will do them good. I'll talk to you tomorrow. Good evening."

Benson turned and walked to the door. "Benson," he said. The voiceprint circuits in the door responded and the door slid open for him, leaving Schwab still sitting at the table in the cell.

Schwab felt reassured after Benson's laughter. Not because he saw anything funny in what Benson was laughing at but because it told him Benson was interested in him as Schwab, not just as a criminal telepath.

IV

Benson sat alone in his office. His partners and secretary were gone but his secretary had done exactly as he had asked before he left for his talk with Schwab. There was a stack of record cards on Benson's desk that would take him half the night to get through.

He slid the top of his desk back and looked at the blank screen in front of him. He took a deep breath and his throat rasped with his cold. The only way to get finished was to begin, he told himself platitudinously, and inserted the first slick card into the slot next to the screen. Then he reached to the visiphone on top of the desk and punched out the local number of the Federation records computer, along with his law firm's account number so they could be billed for the time he used.

"Records," said Benson, "collate the following data with all relevant Federation records, civil and criminal. You might as well throw in administrative as well."

"Yes, sir," responded the computer in a voice that at this hour of the evening sounded to Benson something like his secretary's.

The first of the documents flashed on the screen in his desk. He examined it briefly then pushed the Negative plate and the next document appeared. Court orders, decisions, administrative orders, even pleadings and arguments of counsel flashed on the screen and each time Benson touched the Negative plate and another appeared. Even though what he was examining was so minute a part of the vast Federation records system that statistically it was almost incalculably small, it seemed to Benson as minutes and hours passed that he was examining every record ever kept in the history of mankind and each time it came to nothing until at last he found what he wanted. He pushed the Hold plate and examined the doc-

ment more closely. Then he pressed the Printout plate and waited for his copy of the paper. The paper was a twenty-year-old court order.

"Records," Benson said, "give me a printout of any information relating to one Regina Quinton. She was a resident of the city of New Los Angeles on Wolff 74-5 about twenty years ago."

There was an interval of about two minutes before the computer responded by printing out half a dozen documents on a single sheet of paper that unrolled from below the screen onto Benson's desk, then it stopped.

"All the data under that name," said the computer.

"Thank you," said Benson and hung up the visiphone.

Benson examined the documents for half an hour, reading and rereading them, then he got up and paced back and forth in his office. He looked at his watch. Ten O'clock. McMasters still would be up. Benson touched the visiphone and punched out McMasters's home number. McMasters's face looked more deeply lined on the screen than it did in person. Benson wondered if McMasters used some kind of cosmetic during the day.

"What do you want, Benson? Can't it wait?"

"I'm afraid not," said Benson and tried to make his voice sound as hoarse as possible. He also tried to let his face appear as slack as he could. He noticed in the monitor screen that it showed.

"I'm afraid you were right about my health, McMasters. This cold is doing me in. I'd like to take you up on that postponement."

"What is this, Benson? This afternoon you told me to mind my own business when I asked about your health and now you want a postponement because of it. Absolutely not. Due process demands that we get this over with as quickly as possible. You can never tell what that fellow Schwab will do if we don't get him rehabilitated as quickly as possible."

McMasters was sounding him out. There was no legal way he could get a postponement so McMasters would either have to buy this cold, or Benson would have to think up something more drastic. Perhaps Schwab could get sick.

"In all fairness," said Benson, trying to get as much of a nasal sound in his voice as he could, "you must realize that this is a complicated matter and if I have to hand it over to someone else in the office it might take twice as long for them to get acquainted with it. Just agreeing to a postponement would simplify matters. I want to get it over with as quickly as you do, but I want the man to have the fairest possible chance."

"No," said McMasters, his face resolute on the screen. "This is

some kind of tactical maneuver you're trying to pull, although I can't see where it's going to get you and there is the public interest to consider. The longer this man Schwab goes unrehabilitated, the longer the public is in danger."

"Oh, come off it, McMasters," said Benson, careful to keep the sound of his cold in the forefront of his voice, "my only tactic is to try to get rid of this cold and two weeks isn't going to kill anyone. Schwab will be in jail the whole time. As you know, they probably wouldn't let him out on bail, anyway. If you want insurance, I guarantee we won't ask for it."

Benson could see McMasters was thinking about this and Benson knew it would give McMasters extra time to work on his own side of the case as well as take care of the other pressing business of a Federation Attorney's office.

"You're really sick?" McMasters asked.

"Yes, I'm really sick," Benson answered. He did have a cold.

"All right. Two weeks, a week for your cold and a week to catch up on your work, but I'll see you in court after that."

"Fine, thank you," said Benson.

"Go to some place hot. It will dry you out."

Benson gave a weak smile to show that even in his ill state he appreciated McMasters's double-edged remark.

"I will," Benson said and clicked off the visiphone, but he immediately clicked it on again and punched the number of the jail where Schwab was. The night sergeant's face came on the screen.

"Yes. May I help you?"

"My name's Benson. I'm Ernest Schwab's attorney." Very little of the cold was left in Benson's voice. "May I talk to him."

"Schwab," said the sergeant and looked blankly down at a register in front of him.

"Schwab, Ernest, Seven-two-four-six," said Benson.

"Ah, here he is. The telepath. Just a minute and I'll put him in a visiphone room. Hold on, please."

The screen went blank. A few moments later the Trace light on Benson's visiphone glowed briefly. It irritated Benson to have his word about being Schwab's lawyer doubted, but that was the sergeant's job. Finally Schwab's freckled face came on the screen.

"I'm afraid you're going to be in that jail a little longer than we'd planned. I just arranged with McMasters to postpone the trial."

Benson could see Schwab was depressed by the news.

"I don't suppose it matters," Schwab said. "As long as I'm here, I'm not at a Rehab center."

"Forget that for now, Schwab. I've been checking the public record and I came across something."

"A mortgage," said Schwab. Benson liked that better than

Schwab feeling sorry for himself, although it was natural for people to feel that way in Schwab's position.

"Regina Quinton," said Benson.

Schwab's eyes brightened.

"Who is she?"

"I don't know, yet. But I will. I thought I'd take a little vacation for my health and look her up."

"Yeah, I'm taking a little vacation, too. How did you find her? Does she have a record?"

"No. No criminal record. But she was once sued in tort by the city of New Los Angeles on Wolff 74-5. It was a little over twenty years ago and she was only a five-year-old girl, but it forced her parents to move her outside the city. The injunction read something to the effect that as long as such condition shall continue, said Regina Quinton shall not be allowed to be present within the City of New Los Angeles for a period exceeding three hours daily."

"What was she, a leper?"

"No. An emitter-telepath."

"Which is what?" asked Schwab. Benson could see discomfort in Schwab's face. Since Schwab had only recently discovered he was a telepath—and because of the way in which he had learned—he was sensitive about the subject.

"The tests we took on you show you're receptively sensitive like most telepaths, but one in a hundred emit thoughts normal people . . . excuse me, Schwab, but I have to say it as expressly as possible . . . hear, if that's the right word. As children they can't control it and they're like foghorns in the head of anyone within a mile. You can imagine what a five-year-old thinks about and if you lived in his area, especially *you*, you'd think about it, too, whether you wanted to or not; so they got an injunction to keep her out of New Los Angeles."

Schwab was following what Benson said with intense interest.

"So you're going on this vacation to Wolff 74-5."

"No. Paria. She moved there last year."

Schwab's face relaxed and Benson could almost see hope flow back into it.

"I don't know what that means, Benson, but it sounds like it means something. If I could only go with you—but," Schwab's eyes looked past the camera of the visiphone on either side. "I don't suppose that's possible. By the way, what was she sued for?"

"Public nuisance."

V

Governor Finnley of the Earth Concession on Paria looked at the folder on his desk. What he saw upset him. Here were only two papers in it, a copy of this man Benson's entrance permit and a statement of his purpose in visiting

Paria. He hit the intercom switch and Miss Childs's face came on the screen. Bland pickings, thought Finnley, but more than you would expect on this forsaken rathole and she knew the office inside-out. It was more trouble than it was worth to replace her with someone better looking.

"Miss Childs, are there any more papers on this Benson fellow?"

"No, sir," she said with a finality that Finnley knew meant she had already looked. He hated not having a man pinned down with the proper papers before he talked to him and he felt so far from having Benson pinned down he didn't even know what pin to use. That thought amused him until he saw Miss Childs' obedient, expectant face waiting to see if she was needed for anything else.

"Well, do *you* know anything else about him?"

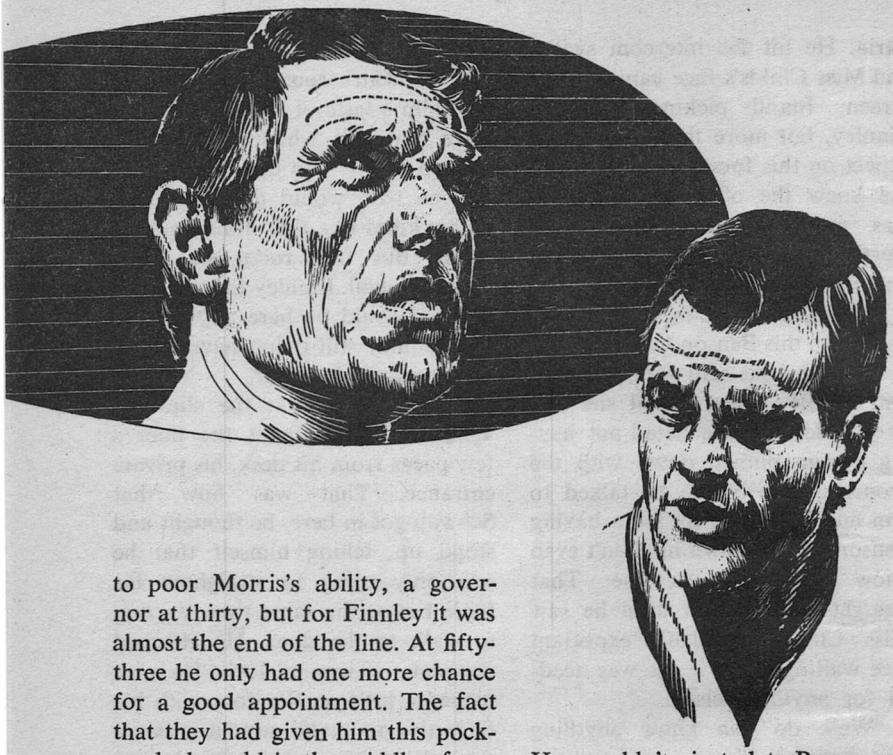
"Only that he's here about your predecessor's unfortunate . . . situation." Finnley noticed with some satisfaction that, although she still used a euphemism for the mindwipe Morris had suffered, she no longer showed too much emotion when she got near the subject. When Finnley had first been posted here, she would burst out crying every time the incident was mentioned. "And that they've put him in the room that killer had."

"Thank you, Miss Childs." The screen went blank.

So they had put Benson in what's-his-name's, Swab, Schwab, yes, Schwab's room. That should give him a taste of what it was like, since that was what he no doubt wanted and it was only fitting that anyone who would defend a telepathic killer like that should get his room. But that room was right down the hall, Finnley thought, and Benson would be here any minute and Finnley still didn't have a hold on the man's character.

Finnley looked at the slim file again and then up at the door a few paces from his desk, his private entrance. That was how that Schwab got in here, he thought and stood up, telling himself that he was only going to straighten his tunic but at the same time starting to walk to the door. He checked the plate; it was on lock. He even tugged a little on the door with his fingertips to make sure it was secure. Benson would come in the front way, past Miss Childs, and he would have some warning.

He walked back to his desk and stood behind it, then picked up Benson's entrance permit. A lawyer, he thought as he held the paper by the corner. Finnley remembered his own youth when he had wanted to be a lawyer. Perhaps if he had finished law school he wouldn't be in this rathole. Oh, this kind of thing was all right for thirty-year-old Jeremy Morris. A man on the way up could afford being stuck in a place like this for a few years. It was even a kind of tribute



to poor Morris's ability, a governor at thirty, but for Finnley it was almost the end of the line. At fifty-three he only had one more chance for a good appointment. The fact that they had given him this pock-marked world in the middle of nowhere, in fact not even the world, just the human Concession to govern, showed that someone didn't have the proper confidence in him. But there was still a chance, if he handled things well here, that he would get some place closer to Earth. After all, a man with his ability—

The visiphone glowed. He touched it on.

"Yes?"

"Mr. Benson is here."

"Have him take a chair a minute, please, Miss Childs," Finnley said and touched off the visiphone. He couldn't just let Benson in without a wait, even though Benson was the only business not a rubber stamp that had come through his office for the past three days. Besides, he wasn't finished reading the two pieces of paper about Benson.

Finnley picked up the Statement of Purpose and glanced over it. Not much here, either, he thought. It just says he is defending that telepath and wants to make a few inquiries. Any fool could see there had to be more to it than that. You didn't travel four days on a starship to a sandbox planet like this

one just to make a few inquiries. Unless, of course, you were making inquiries about F. C. Finnley. You could never tell who this Benson knew.

"Miss Childs," Finnley said into the intercom without looking at Miss Childs's face, "send Mr. Benson in, please."

The door across from Finnley's desk slid back and a heavyset man in his mid-thirties came in. Finnley was struck immediately that Benson looked paler than the depth-photo on his entrance permit. He thought at first it was the light coming through the window which he had noticed did strange things to people's complexions—it was another thing that annoyed him about the planet—but when Benson spoke Finnley could tell he had a cold or something.

"Governor," Benson nodded, "my name is Benson. I'm here to look into Governor Morris's mind-wiping. I represent Ernest Schwab, the man accused of doing it."

Finnley nodded in the long practiced way he had developed to show noncommittal understanding of what was said. At least Benson came straight to the point. That was a point for him. He almost smiled as he thought that but sat up in his chair at Benson's next statement.

"I thought I would check with you first to see if the investigation had gone any further."

"Further! What do you mean? they have Schwab. He did it. What more do they want?" It *was* some kind of test after all.

"Yes. You're right," Benson said, "Schwab is in custody but he hasn't been tried yet and there is some question about his guilt."

"I don't see how there can be any question. As I understand it—and you must remember I wasn't here at the time . . . Morris himself was governor—they caught Schwab standing over the body. *Corpus delicti,* isn't that it?" Finnley had dealt with lawyers throughout his career and once you showed them you understood what they were talking about, you had them in hand.

"Yes, that's part of the *corpus delicti*—the fact that Morris was mindwiped—but they still have to establish that it was done through a criminal agency. That was why I was wondering if Morris left any papers or records of any kind."

Another test, thought Finnley. Who was Benson really working for? They wanted to see if he would reveal Federation documents to strangers. Well, let them try.

"I've been over all this with a colleague of yours, a man named McMasters. He called here several days ago and asked the same things and I'll tell you what I told him. I have collected all of Governor Morris's papers and I plan to pass them on to the proper authorities, and they are not available—as you

should know government papers would not be—to anyone without the right clearances."

"I could have them subpoenaed"

"That is what McMasters said and I told him to go ahead and subpoena them. *That* I can't control." Finnley tried to calm himself. If Benson was from someone else in the Federation structure, it would be best not to antagonize him. It would be enough to show a firm sense of duty annealed by friendly cooperation.

"Mr. Benson, I have read all of Morris's papers, both government and personal, and I assure you, there is nothing in them that can make the slightest difference to the Schwab case."

Finnley saw Benson was unconvinced, so he added, "Either for you or Mr. McMasters." It seemed to satisfy Benson.

"Well, I may have to subpoena them anyway, but thank you for your cooperation, Governor Finnley. You don't happen to know a girl named Regina Quinton, do you?"

Finnley thought a moment. Quinton? He had never heard of her.

"No, I'm sorry I don't, Mr. Benson."

"Thank you anyway, Governor. You don't mind if I look around your little Concession, do you?"

"Not at all."

Benson nodded, turned and walked out of the office. What had Benson's last remarks meant? Had there been a double edge on those thanks for cooperation? And he was going to look around, what did that mean?

"Miss Childs," said Finnley into the intercom, "would you bring me everything you can on someone named Regina Quinton."

Benson walked through the static field. He felt the warm air hit his face and thought he felt his nose start to dry up. The cold had bothered him all the way from Earth and nothing he took seemed to help. He looked around at the flat landscape and thought about Schwab senselessly running out here and up one of the mounds. What people did when they were frightened continually amazed Benson. Finnley, the new governor of this barren world, seemed almost frightened about something, too, but when you had been on these outworlds as long as Finnley had anyone from Earth was bound to raise your suspicious.

He finally saw what he was looking for. A small, plastone building halfway between the edge of the Concession and the beginning of the Parian mounds. Cowdin had his working office there and as general operations manager of the Diversicorp interests on Paria, Cowdin might know something helpful.

Benson began walking toward the building. He wondered why

Cowdin had his office out here when the company supplied him with one that must be the equal of Finnley's in the hotel, but then he realized that supervision of any of the barter with the natives could be better controlled with facilities nearer the mounds than halfway through the Concession. Benson pressed the callplate and the small screen lit up immediately with the face of a rugged featured man whose age could have been anywhere from Benson's own to Finnley's.

"Cowdin," said the man.

"My name's Benson. I'd like to talk to you about Governor Morris if I may."

"Yes. Just a minute," said Cowdin. Benson could make nothing of the tone. He would have to wait until they were face to face. The door slid back.

The office was more like a scholar's than that of someone responsible for the Diversicorp mining operation. Papers and manuals were stacked meticulously on tables around the room and a large desk stood in back of the man Benson had come to see, with papers and pens arranged in neat succession across its surface. Seeing him in person, Benson guessed Cowdin's age at about forty. He had a weathered look as if he had spent many years working outdoors and had arrived where he was now by that work. His complexion was dull and brown but his eyes returned Benson's gaze crisply and directly. Benson could tell Cowdin was used to giving other people orders.

"How can I help you here on Paria," said Cowdin, his voice as rough naturally as Benson's was with a cold. "My secretary in the hotel 'phoned me that you were coming and that you are defending Schwab. I hope you do a good job. We'd hate to lose him. He was a very efficient employee I'm told."

Benson had almost forgotten that Cowdin and Schwab worked, indirectly, for the same company, Diversicorp. Cowdin worked here in their mining operation and Schwab in their interstellar transportation division.

"Did you know Schwab, then?" asked Benson.

"No. But of course, after he was picked up, rumors got back to me from astronauts and through the company grapevine. In any case, how can I be of service?"

"I was wondering if you had any idea why Schwab was called to Paria."

"Doesn't *he* know?" Benson noticed that Cowdin's face showed a properly incredulous expression. Finnley had gone out of his way to explain that he had not been on Paria when it happened but Cowdin had been. Not that that meant he would know anything.

"No. He says he was called here and no reason was given. The way he put it was 'if the brass wanted him the brass could have him. They

were paying for it and the room was air-conditioned.' "

Cowdin smiled. Being one of the "brass," Benson thought Cowdin would be amused and it was better to get on his good side before he made any requests of Cowdin.

"I really don't have the slightest idea why he was here," Cowdin said. "The various divisions within Diversicorp, although they are coordinated to the interests of the overall company policies, are autonomous when it comes to personnel. I forget occasionally that there are divisions other than this mining operation. I'm sorry Gordon Olmstead isn't on Paria just now. He's the Transportation division's liaison man and might know more about it."

Benson was silent, hoping his expectation of something more might draw Cowdin out.

"I could try to find out if there was any information available on it at Gordon's office," Cowdin said, "but Gordon runs a pretty tight ship over there and in spite of the fact that I've been looking in on his office for the last two months while he is on Earth, he would probably be the only one who would know."

Benson watched Cowdin turn and look out the window then wave his arm to direct Benson's attention to the scene.

"Have you been on Paria before?"

"No."

"Most people would say that was fortunate but I rather like the place. I can imagine that a man like yourself with several academic degrees to your credit and the interest a lawyer must take in the world of men, you can appreciate that there are things to learn anywhere one goes." Cowdin nodded toward the monotonous landscape outside the window, spreading to the horizon interrupted only by the irregular pattern of Parian diggings. "Even in a place like this."

"Yes, I suppose even a desolate spot like this can even teach something," said Benson, at a loss for anything insightful to add to Cowdin's remarks but wanting to encourage him to show more of himself than he had up until now.

"Take the Parians, for example. Our new governor thinks them idiotic, pointless creatures. He has a speech which I call 'Burrowers Number One' because I.m sure there will be more as he is with us longer. He thinks it useless for them to tunnel under half a continent. I have tried to point out to him that they, no doubt, think it pointless to pack dirt in long silver tubes and shoot the dirt up in the air, as we do. He responds that it is perfectly obvious that the ore that produces tantalum and niobium and is in turn used in everything from starship drives to apartment house reactors, is not a useless activity. Are you at all interested in this, Mr. Benson?"

"Yes, I am. Please continue."

"I told Finnley to explain that to the Parians and while he was at it he could let them explain why they tunnel. For what is absurd to our eyes is the very essence of Parian life. Have you read any Anthrozoology, Mr. Benson?"

"Only in college," answered Benson, disquieted by the atmosphere of Cowdin's conversation although he had no idea why, with such innocent content. Atmosphere was a quality Benson had trained himself early to be sensitive to. The most delicate negotiations for Benson's clients had often been successful through sensitivity to atmosphere alone.

"It is a fascinating field, especially for one who has traveled to many worlds. The habits of creatures within the human range of intelligence and most especially the reasons they do things—like our Parians out there—are endlessly interesting to me. Studying such things one is studying more the philosophy of a species."

Cowdin turned his head from the window and continued.

"The studies on Parians are, unfortunately, inadequate. I have tried from time to time filling in some of these holes with my own efforts at observation and explanation in several articles. Poor Morris helped me on many occasions. He was a brilliant man. And his understanding was not limited to the Parians. He understood men as well."

"They always say the qualities of the observer are reflected in his observations," said Benson, quoting a dimly remembered platitude from some mandatory undergraduate science class.

"Quite true, Mr. Benson. Morris knew Parians because he knew men. There is something of men in the Parians. You see their mounds, apparently at random out there. Each is placed in a pattern that it would take hours for me to explain. It relates to their dreams for themselves and their concept of a well ordered universe. The fact that they dream is enough of a revelation, but that they aspire, is incredible. They work constantly and they plan, in their simple way, thoroughly, and to them we are only a means to obtain better tools to network their world to fit their plan. That is their nature.

"Men, of course, plan or we wouldn't be standing on this world millions of miles from Earth, but men's plans are often at cross purposes without the concerted community effort of the Parians. What do you make of that?"

"It's our nature I suppose," said Benson. "I wonder if I could make one request of you, Mr. Cowdin?"

"Yes. Certainly. Whatever I can do to help."

"Do you know a girl, probably about twenty-five, named Regina Quinton?"

Cowdin's expression remained the same but Benson could almost feel Cowdin's rapture in his discourse fade. The atmosphere, noted Benson, had changed slightly.

"No. I don't believe so. Does she work for us?"

"I don't know."

"I'll check," Cowdin said and walked over to a visiphone alongside a neat pile of papers. He punched out a two-digit number. A young girl's face came on the screen.

"Mrs. Wells, would you check our personnel files and see if we have someone named Regina Quinton, working for us here?"

"Yes, sir," she said and left the screen for several minutes. Benson and Cowdin waited in silence until she returned.

"We have no one whose name begins with Q working for us on Paria, sir."

"Thank you." Cowdin touched the visiphone off. "I guess I can't be of any help there either, Mr. Benson. I will check at Mr. Olmstead's office and see what I can find out for you. But as I said, I don't expect much."

Benson could see the conversation was ended.

"Thank you for your help, Mr. Cowdin, and for your insights into Parian behavior." Cowdin nodded.

"If I need your help again," Benson asked, "may I call on you?"

"Of course. I'm here most of the time."

Benson sat in the room that had been Schwab's and experienced something like *déjà vu*. He had examined the kineticorder tape of Schwab in this room minutely and his familiarity with the room on this unfamiliar world was disconcerting. He thought about Finnley and wrote him off as a self-important, petty bureaucrat whose subservience to his superiors might be useful as long as he didn't become officious. Cowdin was another matter.

Cowdin was so deliberately unable to help Benson that Benson made a note to look into Cowdin further. Cowdin was self-possessed and intelligent enough, but there was something more to the man. Benson would have to find out what it was before he could determine whether Cowdin's ingenuous efforts to help were sincere or an illusion.

Motive, thought Benson. He remembered telling Schwab that motive was immaterial and here, when the question was judgment of a man, not simply an act, motive became all important. On the level of thought between men there was a difference between assassination and euthanasia if not within the contemplation of the law.

Benson began pacing the room as he remembered Schwab had done. He looked out the window

as Schwab had looked out the window on the kineticorder tape. And Benson, too, had the odd sensation, while he stood alone in the room, of being watched, although Benson didn't compare it to Schwab's experience. It was late afternoon and would be for another eight hours as Paria slowly rotated. The shadows of the Parian mounds elongated, imperceptibly filling the space between mounds and Benson watched the shadows of the mounds extend as he did the shadow of the man standing in the doorway of the supply warehouse opposite the hotel.

Benson watched the man but he was too far away to discern his features. Whether it was the rock he turned over at Finnley's office or at Cowdin's, or a rumor from either of them, Benson could only guess, but it seemed to have forced something out.

In spite of his inability to tell where the man had come from, Benson thought as he watched the figure in the doorway, it would be a good idea to be able to recognize him if he ever ran into him in more crowded circumstances. If he had a pair of binoculars, thought Benson and then smiled at the thought of himself packing binoculars on Earth to somehow be ready for this moment. All he had were his wits and a cold and both seemed to be disappearing.

Benson looked around the room and his eyes fell on the visiphone. He walked to it, picked it up and carried it back to the window. He turned it so that the camera pointed out the window and touched it on. Colored static played across the screen but the monitor screen filled with the image of the warehouse. He turned the visiphone so that the doorway and the man in it were centered on the smaller screen and turned the resolution as far to the right as he could. The screen filled with the doorway and the man. It was Schwab.

VI

Governor Finnley had been working late in his office but now he paced back and forth, agitated to action by this new threat to his position in the service. Escaped! he thought. That telepath Schwab had escaped! Who could say what kind of a trail of empty shells he had left behind him! And he was likely to come back here. They always returned to the scene, although why anyone would want to return to this pile of gopher holes, he didn't know. But there was the bulletin on his desk and here he was in his office without even Miss Childs to warn him of anyone's approach. Finnley sat down behind his desk.

Finnley told himself not to get excited. Schwab had no reason to come after him. But Schwab had no reason to mindwipe Morris ei-

ther and he had done that. Finnley got up again and walked to the private door. The plate was still on lock. He walked to the door into the outer office, satisfied himself that it was empty and returned to the desk. He touched the visiphone and punched out the two numbers scribbled on the outside of a thin folder on his desk. Benson's face came on the screen.

"Escaped, Benson! That killer of yours has escaped!"

"Which killer of mine?"

Devious again, thought Finnley and decided to let Benson know who ran this Concession.

"Schwab, that's which killer. I have it right here and I want you to understand that if he shows up here, you are to call me immediately," said Finnley, then added, "after you call the Concession police, of course." Finnley touched the visiphone off.

Benson was right down the hall, he thought, picking the bulletin of Schwab's escape off his desk and examining it, and if Schwab was foolish enough to come back here he would go straight to Benson. He would have to find out whose misguided sense of irony had put Benson in that room so close to his office. Schwab was probably still on Earth, anyway, or halfway to Saggitarius, but it never hurt to be safe. Finnley touched on the visiphone again and pushed a red plate at the bottom of the dial buttons.

"Concession Security, Lieutenant Jenkins, sir."

"Jenkins, send two men up to my office, immediately, and have them changed every six-hour-shift until I tell you otherwise."

"Yes, sir."

Benson looked at Schwab sitting on the couch, his chin in his hand, resting his elbow on his crossed legs.

"That was Governor Finnley, Morris's successor. You've got him a little worried," Benson said as he checked to make sure Schwab was out of the line of vision from the visiphone. "Why did you do it?"

"The footprints," said Schwab but before Benson could ask any more questions the visiphone glowed again. Benson answered. McMasters's lined face came on the screen.

"Benson," McMasters said. "I've been trying to get hold of you for the past five days. They said you couldn't be contacted while your ship was in subspace and you've been out of your room everyday I called you there. I thought you would like to know, that man Schwab of yours has escaped."

"Yes. I heard. The governor here just called me."

Benson could tell McMasters had designed this conversation to get Benson's reaction and McMasters's expression broke when he heard that Benson already knew

the carefully planned denouement.

"Listen, Benson, I'll be frank with you. When I called your office it took me half an hour to get out of Miss Webster where you'd gone on your little health holiday but as soon as she said Paria, I knew you were as healthy as I am. I warn you, if this whole thing was some kind of delay to give that man a chance to escape, you are not going to be an attorney for very much longer. You may even need one yourself and the Bar Association will hear about it. It is absolutely the dumbest trick I have ever heard."

"I didn't have anything to do with it, McMasters. You can have my word as an officer of the court on that."

"I hope not, Benson. Whether you did or didn't, this incident's about given me the case," McMasters said, watching Benson carefully.

"You're sure about that."

"So you *do* know something about it."

"No. I gave you my word, I had nothing to do with the escape. How did he do it?"

McMasters began to look tired and distracted. Benson could imagine the pressure that must have come down on his office when Schwab escaped even though McMasters had nothing to do with keeping him locked up.

"I'll tell you, Benson—and I really shouldn't tell you a thing like this, all things considered—but you have to admire the man. There he was in the tightest institution ever created to cage up human beings and he just walked out." McMasters's face brightened with memory. "He hit the callplate in his cell and he told them if they didn't open up, he would mindwipe everyone in the building. I've never seen anything like it."

"And they just let him go?" Benson said looking slightly past the visiphone to where Schwab sat smiling passively from the couch.

"Well, what were they supposed to do? The man had done it once! Everybody in the place knew it and they didn't know whether he would do it again and they couldn't take the chance. They tried to reach you, but you'd been gone for two days so they called me. What was *I* supposed to tell them? I said as far as I knew he *could* do it, so they let him go and said they would give him a half hour. Of course they didn't intend to give him the half hour but as it turned out they gave him three hours. They had to decide how to arrest a telepath who could mindwipe people that got near enough to arrest him. They went over the tapes of his arrest where you are, on Paria, and they decided he must have been so confused he couldn't mindwipe the guard there and by the time they figured out a plan to confuse him here he wasn't around to confuse."

"I suppose," said Benson, "that will slow things up a little."

"Dead stop," answered McMasters.

"Well, so that you will be fully informed of my whereabouts" said Benson, "and won't have to go around browbeating my secretary, I'm staying here for a few more days to look around."

"I really don't care what you do, Benson, but if Schwab shows up there, you better turn him over to the authorities or the Bar Association *will* have something to say to you."

"McMasters, are you paying for this call or am I as a taxpayer?"

"Good morning, Benson," McMasters said and the screen turned to static.

"McMasters was right," said Benson. "That was a dumb trick. How did you get here?"

Schwab's pensive expression disappeared under a playful smile.

"Same way you did," he said, "by starship."

"Don't be cute, Schwab. Anything like a chance you might have had walked right out of that jail with you and unless you've got a damn good reason for showing up here, I'm going to call Finnley and let him have you. You heard McMasters. If they find out I didn't turn you over to the authorities as soon as I saw you, the Bar Association is going to have one word to say to me. Out. They'll say you were a good lawyer, Benson, but not a man of honor. Moral turpitude, impropriety, whatever you call it, it means out for Benson and that is not going to happen, not for you or anyone."

With some effort Benson controlled his personal feelings. Schwab had escaped from the best product of a thousand years of jail architects, then he had made his way here across half the galaxy. He deserved some respect for that feat, no matter the reason or its effect on Benson's life.

"Now, how did you get here, and why?"

"When you've been in space as long as I have, you make friends," answered Schwab, "and I had to come when I realized about the footprints. I went over and over the whole thing in my mind and I kept asking myself was I guilty. I had mindwiped Morris but at the same time I still didn't think I had done what they said I had done. I kept asking myself what I had done and to answer I had to rethink the whole day. I don't know how many times I went through it but one of the times I remembered the footprints.

"When I was in the tunnels, just before I was arrested, I was in a sort of intersection. The light was coming in through the vent hole over my head and I could hear the Parians getting closer to me. I was about to start running again when

I saw the footprints and at the time I thought I must have been running in circles like they say people do, but they couldn't have been my footprints, Benson, because after the Concession officer arrested me, we walked about a mile and a half back through the tunnels where I had run and we never crossed a place where there were more than two sets of footprints going the other way—mine and the officer's. I hadn't circled around at all."

Benson looked at Schwab and smiled for the first time since Schwab had entered the room. Single-handed Schwab had escaped from the most modern jail in the history of imprisonment. Benson imagined Schwab moving across space from planet to planet, ship to ship, never knowing when he changed ships whether the friend he had relied on was really a friend or would turn him in. At any time after Schwab had passed to a new ship, someone in the chain of friends behind him could turn him in. Any of a hundred reasons would do, anxiety at being an accomplice, old hatreds Schwab had developed, or jealousies, or even an innocent slip of the tongue—anything would do. Only once did a reason have to surface in an action for the authorities to hear that Schwab had passed this way and Schwab would be lost. And the all important incentive, thought Benson, for walking this thread from Earth to Paria was a footprint in a dirty, burrowing rat's tunnel.

"But why did *you* have to come?"

"I thought to myself, they know Benson is there, so if I just tell him about it, he still wouldn't be able to do anything but I could go into the tunnels and they would be off their guard. That's what I thought. I guess I wasn't thinking too clearly."

Benson looked at Schwab. He felt swept up by the incredibility of the man. He had to shake his head to keep his own thoughts coming clearly.

"What, if you know, did you expect to find in those tunnels?"

"Regina Quinton."

"Regina Quinton! What would *she* be doing in there?"

"I don't know, yet. That's why I came. You haven't found her here in the Concession, have you?"

"No," admitted Benson. He thought about it. Going into the tunnels was out of the question. If Schwab went alone there was no telling what would happen. They would have no way to communicate or co-ordinate their activities.

Benson stopped himself. He was starting to think like Schwab, not like a court officer. The way to handle it would be to contact Finnley and let him go in there with a squad of Concession police. But would Finnley do it? The more Benson thought about it the more

he knew that Finnley would do absolutely nothing on his own. Before he would move, Finnley would go through so time-consuming a chain of bureaucracy that half the Concession could be moved out before they got to it, whatever it was. And asking Cowdin's help was out of the question, too. Cowdin may, or may not, know something about Regina Quinton but in any case he would be against the idea of disrupting the Parians on the vague hunch of a criminal telepath by going into their tunnels, if only from a business viewpoint. That, decided Benson, left Schwab and Benson.

"Just when did you want to start this sewer search, Schwab?"

"Early tomorrow. That way there won't be any activity around the mounds or in the tunnels and I can slip out of the Concession without anyone noticing."

"We can slip out," said Benson.

Schwab nodded agreement and smiled.

"By the way, Schwab, would you have done it?"

"What?"

"Mindwiped the whole jail if they hadn't let you out?"

"I don't even know how I did it the first time, Benson, much less how I'd do it again."

VII

Regina Quinton lay on her couch in her room. The computers on the opposite wall were blank and lifeless. When they were on, the colored lights reflected in the brown glass figurines of the cuddliest animals from a dozen worlds that sat on top of the console and memory banks. Without moving her head she could see glass fawns from Earth, glass ernews from Wolff 74-5, glass veltors from the distant world circling Alpha Centari. Around the edges of the computer were chintz frills she had attached to brighten up the room and a pink, red and yellow pattern lent color to the curtains with which she usually covered the computers. But Mr. Cowdin was coming today so she had opened the curtains. He didn't like the curtains anyway but as long as she took care of them and didn't let them get in his way, he would let her keep them. He was a nice man in his way. Mr. Cowdin was coming because she had to make that man Schwab good again. He was acting bad. She had made him good once but she must do it again.

Regina heaved her heavy head to the other side of the organdy pillow on which it lay. One day they would be able to make more people nice than just one at a time. But for now, she and Mr. Cowdin would have to be satisfied with one. It upset her to think how many people there were who weren't nice to each other. She wouldn't think about it any more.

But she would have to because Mr. Cowdin was coming.

Regina moved one of her thick legs into a more comfortable position on the couch and adjusted her long, loose shift so that it covered her knees. If only people were nicer. She didn't like living down here, but it was better than living with most people. People had been mean to her all of her life. When she was a little girl, she remembered and looked at the giant stuffed panda bear from Earth that stood next to the computer console, they had been mean to her because she was a telepath. They had made her live outside the city where there were no other children to play with and even though she couldn't help being a telepath, people had shunned and avoided her all her life.

Even when she got old enough to control what they heard in their minds, people weren't nice to her because of her appearance. Eating was one of her few pleasures, although she didn't like it that much because of how it made her look. But people would be nicer soon.

The door slid back and Regina could see the rough walls of a Parian tunnel behind Mr. Cowdin as he entered. He was a nice man sometimes, but those rats were awful. They were dirty and stupid and she didn't even like to look out the door at their tunnels. Mr. Cowdin kept it very clean in her bedroom though.

"Regina," said Cowdin, his face was worn by the time he spent in the weather outside the Concession's static field, "we have to help that sensitive Schwab again. He is here on Paria."

"How do you know he's here, Mr. Cowdin? You said he went back to Earth after we helped him." Regina was sorry sometimes that she could only emit her thoughts. She wished she could be sensitive to other people's thoughts like that Schwab, then she wouldn't have to rely on interpreting what people said and how they looked. She was inexperienced doing that and it was hard to tell how truthful people were. She had believed people many times when they said they liked her and they almost never told the truth.

"It doesn't matter how I know. Someone in Transportation told me. The man felt guilty about letting Schwab on Paria without an entrance permit and the proper papers."

"He is acting bad again," Regina said, her round cheeks puffing into an expression of disapproval. "He should follow the rules if he is going to be nice."

"That is exactly what I thought and we must help him."

"All right. I'll try to sleep."

"Good," said Cowdin and Regina saw the colored lights of the computer reflected in the bodies of the fawns and the ernews and the veltors.

Benson fell into a heavy sleep. What energy his cold had left him had been sapped by the last three days on Paria, especially the events of today, and the long Parian night would let him get in nine hours sleep before dawn. Schwab had taken the couch and he was on the bed. He had no dreams nor did he move from the position he had fallen asleep in until morning, then thoughts began to surface. Slowly, after the hours of sleep, his mind rose to the edge of wakefulness and vague mixtures of impressions moved back and forth across his conciousness. Finnley, McMasters, Schwab were all mixed together into a composite man who climbed down, down into a Parian mound and then decomposed and reformed into the image of Cowdin. Benson came completely awake. Schwab was standing over him.

"Schwab," said Benson, shaking his head, "you scared me."

Schwab was silent.

Benson looked at Schwab and through the boyish freckles, Benson saw an expression that was new on Schwab, but one that he recognized. In Benson's mind thoughts were beginning to swirl and he tried to grab onto something in the confusion of images and feelings and impressions that washed through his head like confetti in the air around a parade. Colored lights and distorted animals played through his head, and feelings from everytime of his life echoed in him. And then he remembered the tape of Schwab standing over Morris and focused his attention with the last efforts of his will on that memory and struck out at Schwab, bringing the back of his fist across the side of Schwab's head. Schwab's head snapped to the left and then he seemed to collapse as if all the tone had left his muscles. Schwab was still on the floor.

Benson's head cleared.

Schwab began to move and finally looked up at Benson, a confused helplessness on his face.

"I'm sorry, Benson," he said and pushed himself up on his elbow, shaking his head. "I almost—"

Benson looked at Schwab on the floor and a chill went through him as he knew his feelings were those Morris had felt the last few seconds he had been Jeremy Morris.

"Benson, I'm sorry. I almost did it to you." Schwab still looked at Benson. "What am I, Benson? I did it to Governor Morris and I almost did it again. And to you the only one who's helped me at all. I couldn't sleep. I was looking at you asleep and not moving and I got up and walked over to you and—call Finnley! I can't do this!"

"Are you all right now, Schwab?"

"I think so. I don't know. I don't know."

"What do you remember just

before I hit you?" Benson asked.

"Nothing. I don't know. Just that I was confused, like the other time."

"Do you feel the same way now?"

"No."

"Good. It's dawn."

Moving imperceptibly into its sun, Paria spread a dull fire of dawn across its horizon. Schwab could see the yellows and oranges silhouetting the Parian mounds as black eruptions on the skyline. As they left the static field surrounding the Concession, the air had changed from the constant 75° within the Concession to 40° outside and it would be colder inside the tunnels.

They walked toward the mound which Schwab had run to a month before and neither spoke. Schwab noticed that Benson let him lead and wondered whether it was only because Schwab had been in the tunnels before or because of something else, a lack of trust. He recognized that Benson would take no more chances with him after this morning and he couldn't blame Benson.

He could only blame himself, he thought as they approached the mound. It had come over him so suddenly, almost impulsively, just as it had with Morris, but this time Schwab did feel guilt. He felt responsible, not directly for the act he had almost done, but because the victim was Benson. If they were wrong and there was nothing in the tunnels, Schwab would have only one alternative. He would have to turn himself in and hope that whatever in him caused him to do these things could be cut out of him at a Rehabilitation center. He could not let himself do it again.

At the foot of the mound Benson motioned for Schwab to go up first. Schwab was upright at first but as the climb got steeper he had to put his hands down into the loose dirt for balance. Finally they reached the top. Had it been this steep the first time? Schwab felt apprehensive. If his memory had been this inaccurate about how steep the mound was, how accurate would it be inside the tunnels?

Schwab looked down into the tunnel from the crest of the mound and started down it. His heels sank into the dull brown dirt that overflowed into his boots. Toward the bottom of the hole the climb was again steep and he had to turn around and face the side of the shaft and back down. Benson was above him, negotiating as best he could by trying to step where Schwab had stepped. Schwab felt more solid ground underfoot.

Schwab waited for Benson to get to the floor of the tunnel and looked off down each of the underground passages. It seemed near freezing in the tunnels and they were dimmer than he re-

membered. They would get lighter as the sun rose higher outside. And warmer, he thought.

"Which way?" asked Benson.

Schwab looked at the tunnels. The last time he had entered them he had chosen at random, or what seemed like so, but this time he had no hesitation in choosing a tunnel.

"This one," he said and they started into it. Only occasionally did they have to stoop or turn sideways as they worked their way through the Parian corridors. The tunnels were built to accommodate two Parians abreast if necessary and with a ceiling high enough to move objects larger than the Parians.

"Schwab," said Ben on behind him.

Schwab stopped. Benson's expression was worried.

"Are you sure you know where you're going?"

"It feels like it," was the only way Schwab could express it.

"Feels like it! Don't you know? We're acting on enough of a hunch coming down here at all. We could follow hunches halfway across the continent. And I've been looking at these walls. There isn't a thing shoring them up. The roof could cave in any minute."

"The Parians have been building these since long before we were here," Schwab said. Benson's misgivings about coming into the tunnels were understandable, thought Schwab and asked himself again about the feeling that was guiding them through the network. It was something stronger than a hunch and it grew stronger each time they came to an intersection and Schwab had to choose again.

"It must be a spurious sort of emission," Schwab said to Benson, "that I'm sensitive to. As we get closer—"

"We're getting closer then," interrupted Benson.

"Yes. I keep getting stray thoughts that can't be mine. Pictures of animals and an unsettling sense of having my feelings hurt. But they aren't my feelings."

"All right," said Benson and Schwab could see that what he said made more sense to Benson than it did to him. "Let's go."

They walked through the tunnels until they came to an intersection of five tunnels. The morning light outside seemed to drop slowly down the hundred-foot shaft above them but it seemed no warmer.

"This is as far as I got," said Schwab and began to look around the floor of the tunnel until he saw a well worn path coming out of one tunnel and going into another. It was impossible to tell from the mashed dirt which direction was the one they wanted. Schwab chose one without hesitation.

They walked about a hundred

yards into the tunnel and came to a door. Schwab looked back at Benson.

"Well, open it," said Benson.

So familiar and human a door in so unfamiliar a place was unnerving Schwab. He touched the plate and the door slid back. Again the familiar assaulted Schwab but in an inappropriate mixture. The room was a cross between a data-processing center and a young girl's bedroom. The wall to their left was computer memory banks and analog circuits. Opposite where they stood was a master console with a giant stuffed panda bear leaning against it. On top of the computers was glass bric-a-brac and along the computers themselves were frilly curtains but most unsettling of all was the girl on the couch to their right, Regina Quinton.

She sat on the couch that sloped up at one end and covered it. She was so fat she almost seemed to spill over the edge of the couch and blocked any view of it except for the two corners of cushions beside her ears. Her hair was simply combed without thought to design, only to keeping it out of her eyes. Her face was puffy with fat that ran down her neck to her dress. Her legs were stretched out on a four-foot circular cushion and the part of them that Schwab could see, from just below her knees to her thick heeled shoes, was white, fat and blue veined.

"Please don't hurt me." she said.

Benson pushed past Schwab and looked at Regina. Schwab could see in Benson's expression that he had decided she was no immediate threat to them, then Benson walked over to the computer console to examine it.

"You are that mean Ernest Schwab," Regina said.

"What is all this, Benson?"

Benson looked up from his examination of the computers, his fingers still on the console.

"If we were on Earth, I would say it was a kineticorder installation, or something close to it." Benson turned to Regina and an expression of demanding authority came on his face. He repeated Schwab's question but in a voice almost fierce.

"What is all this!" he yelled. Schwab could tell by Benson's tone that the abrasive force of what he was saying to the helpless fat woman was a posture. More like Benson was badgering a witness on cross-examination, than actually angry. Regina, a stranger to Benson, interpreted it as hostility. Her eyes blinked, squeezing out a tear that rolled out over her round cheek and fell on her dress.

"It's how we make people like him," she answered and her eyes turned on Schwab, then back to Benson, "and you act nice to other people."

Schwab could hear her voice clear and almost feminine in the

distinct way every word was formed, yet her lips moved only slightly. She wasn't speaking at all, he realized. Her lips moved with the words as some people's lips do when they are thinking but the sound was inside his head.

"How do you make people nice?" Benson shouted with the same force he had before. Schwab understood, as he stood looking at Regina, how the guards and people in the jail on Earth had felt when he had demanded to be released.

"Benson, don't get her excited."

"Shut up," Benson snapped and turned back to Regina.

"How?" he shouted.

Tears were flowing steadily from Regina's eyes.

"I go to sleep and help Mr. Cowdin," she said. Her voice in Schwab's head had none of the hesitant shaking he expected, but remained clear and distinct with an undertone of fear.

"Who's Cowdin?" Schwab asked.

"Benson!"

Schwab was startled by the male voice. It came from the tunnel outside the room.

"That," said Benson with none of the cross-examination harshness in his voice, "is Cowdin. Close the door, Schwab."

As Schwab touched the plate, then turned it to lock, he could see that the tunnel was filled with Parians. He saw no sign of the man. He heard Benson in back of him say, "Regina, it's time for a nap."

VIII

Governor Finnley sat in his office. There still was no word about that man Schwab. The sooner they caught him the better, for everyone. The more he thought about Schwab the more he realized just how vicious the man was. Anyone who would turn such a powerful talent to such evil purpose, anyone who would mindwipe a governor, must be close to insane. Schwab could have put himself to productive use at a Rehabilitation center. It would cost the taxpayers less than maintaining the staff they had to in order to accomplish the same thing with technology.

Finnley looked at the papers on his desk: Benson's entrance permit, the entrance permit of Regina Quinton, a year old now—whoever she was. He had put tracers out on her and nothing had shown up—and Morris's papers. This last stack was the largest. Morris's official reports and his private papers. Finnley had been over the reports and found them all clear and concise evaluations of whatever their subject was. An admirably intelligent man that Morris. Too bad about—but these personal papers he could make nothing of. He had read them three times this morning and still they told him nothing.

The first time through he thought they were some kind of Anthrozoological report. The second time he realized they couldn't be that because they mentioned Cowdin and particular conditions and circumstances here on Paria, rather than just general observations about the Parians themselves, although there were enough observations of the filthy gophers' habits. The third time through he had concluded they were a philosophical treatise Morris must have been working on with Cowdin. It kept harping on a well-ordered universe —the order of everything from a solar system to an atom—and referring constantly to the habits and customs of the Parians. How the Parians worked in simple, communal harmony toward higher spiritual values by their digging. All these observations seemed to be quoted from Cowdin, and Morris had not completed the text so there were none of his conclusions.

Well, thought Finnley, *He* couldn't make heads or tails of it either, although he liked the idea of everything working harmoniously.

He looked at Benson's entrance permit and this Quinton woman's and Morris's papers and thought about Schwab and suddenly it came clearly to him. Schwab and Benson and this Quinton were down in one of the Parian tunnels and Cowdin, who had some sort of psionic equipment for constructing this well-ordered universe and who had mindwiped Morris because of what he uncovered, had them trapped. Then the thought seemed to become indistinct but the conclusion remained. Why hadn't he seen that the first time through? It was so obvious.

"Miss Childs," Finnley said into her face on the visiphone, "will you tell Lieutenant Jenkins to come in here immediately and to bring about a dozen men."

Lights stopped reflecting in the glass veltor as Benson sat at the console of the computer.

"He cut the power," Benson said. Benson stood up and walked over to Regina, asleep on the couch and shouted but not with the harshness he had before. "Regina!" He looked over to Schwab by the door.

"That's what you heard standing over Morris."

Regina shook her large head and looked up at Benson. Benson could hear her speak loudly in his head. She had excellent control of speech, he thought, for someone who had seldom spoken in her life.

"What have you made me do?" she said and began crying again.

"Only the right thing, Regina." She didn't trust him now but she would. He noticed that in spite of the harsh tone he had taken with her, she was responding to his reassurance. People who had been ostracized all of their life, he

thought, never developed that critical sense that comes from dealing constantly with people and that had obviously worked in Cowdin's favor when he coaxed her into this whole affair.

Benson looked at Schwab's face. It registered such confusion and apprehension that Benson felt he should explain. Everything he personally could do was done, so he dismissed Cowdin's proximity from his mind as immaterial, noticing as he did so that Schwab had obviously not dismissed the thought.

"Don't worry about him," Benson said, "either he gets us, or he doesn't. It's out of our hands." Benson saw his attempt to calm Schwab had somehow failed to make headway against Schwab's apprehension. "You asked me once if there was such a thing as a mind probe. Remember?"

"Benson, I don't care about mind probes! All I care about is getting out of this place. Alive."

Benson ignored Schwab's comment and continued.

"This is the closest thing there is to it. It's very much like the equipment they tried to use in the courts about five years ago, except if I'm right, it works the other way. Regina, as you saw, is conditioned almost as intricately as the computer is programmed. Cowdin must have done that the first time he used this with her." Benson gestured toward the computers, then brought his hand around to Schwab who was about to protest again. "He fed in what he wanted and it reintegrated in her mind and was directed where he wanted it. And with you on the other end he could not only influence a decision or put conclusions where he wanted them, he could use Regina's talent, the computer and your sensitivity to mindwipe."

The callplate next to the door glowed. Schwab stood still and Benson had to walk over and touch it on. As soon as he saw Finnley's face he turned to Schwab. "Well, open the door."

IX

Benson felt like needling someone, anyone. He was impatient to leave Paria. He and Schwab had seen nothing of Finnley for the two days they waited for the starship now orbiting Paria. Finnley had interviewed Regina for the reports Benson knew he had been writing and probably talked to Cowdin at the Concession Security office. But he had talked to neither Benson nor Schwab during the time, even though his office was only two doors from the room Benson was in and four doors from the room they had given Schwab. He had been absent even when Regina left to return to Wolff 74-5 after she was cleared of any charges and only now, when they were preparing to leave, did he appear in the room, so Benson chose Finnley to needle. He did so

by packing the last of his clothes, silently.

Schwab sat on the couch in one of Benson's suits, which fit loosely on him but was clean. Finnley was perfectly dressed in his official tunic, everything neat but his face which reflected by its tight lips and blinking eyes that his mind was worrying something to death. Benson let Finnley worry it and went on with his packing. Whatever it was would soon enough be out among them without encouragement. Besides, thought Benson, for some perverse reason he enjoyed seeing Finnley agitated.

"Why," said Finnley and Benson sensed it was time for whatever was distorting Finnley's face to pass through his mouth, "did you go down there without contacting me? *I* was the proper person to handle the matter from the beginning! If you had contacted me and been perfectly frank, I would have come to the conclusions I did about Morris's papers long before you got yourself into that mess."

"We thought—" began Schwab, but Finnley cut him off and Benson shook his head for Schwab not to continue.

"Do you know what Cowdin had on him when we arrested him in the tunnel? A nerver! Why if he'd got through that door you would have been worse than mindwiped. You would have felt like your spine was pulled out of your back and that would have been it!" Finnley's right fist bounced away from his left palm with the "it." "I don't know where he got it. They were outlawed before I was born. But he had one. I thought for a minute he was going to use it on us but fortunately I had brought enough men with me—"

Finnley stepped toward Benson. "*Why* didn't you come to me?"

"We thought you would figure things out," said Benson.

"Well, you were right there. And lucky for you. Now I suppose you'll go back to Earth and defend Cowdin after he almost mindwiped you and murdered you."

Benson laughed.

"No. There's not much chance of that. I'll probably be a witness against him which should be in-

THE ANALYTICAL LABORATORY *September 1969*

PLACE	TITLE	AUTHOR	POINTS
1.	Your Haploid Heart	*James Tiptree, Jr.*	2.70
2.	Stimulus-Response	*Herbert Jacob Bernstein*	2.95
3.	In His Image	*Robert Chilson*	3.16
4.	Damper	*E. G. von Wald*	3.33
5.	The Visitors	*Jack Wodhams*	4.16

THE EDITOR

teresting, having McMasters examine me."

Schwab, Benson noticed, had an impish smile on his face.

"How would you defend Cowdin?" Schwab asked.

"Cowdin," Benson said, "as I said, is not my problem. He's probably insane or close enough to it that it wouldn't be too much of a problem. He has an insane sense of public service in any case, not that I'm against public service, you understand," Benson said, glancing at Finnley. "But it's you, I'm worried about, Schwab. You forcibly escaped from jail and that sounds like a felony to me."

Benson packed the last of his socks into his bag and watched Schwab's face cloud with gloom out of the corner of his eye.

"But I didn't mindwipe Morris," Schwab protested after several minutes. Finnley was watching the exchange with satisfaction that attention was being directed away from him.

"But you did escape from jail," answered Benson. The visiphone glowed.

"Well," said Finnley, taking the call as an opportunity to become disembroiled from the conversation, "I have work to do but, Benson, you make sure Schwab gets back to Earth. And stays there."

Finnley left and Benson answered the visiphone. McMasters looked soberly out.

"I'm glad I caught you before you boarded. I just read Governor Finnley's report on your health vacation at the local spa. It didn't sound too healthy."

"McMasters, do you have any idea how much of my tax money a call like this costs?" said Benson.

"All right. I'll get to the point. We seem to have run into a problem with that Schwab man of yours." McMasters shook his head in what was obviously mock perplexity. "Heaven knows I've done everything I could to nail the fellow to the wall, but, alas, I can't find a statute that covers him. I even considered assault and battery for a while but that won't work."

"I don't really want to say anything, McMasters," Benson said, in a mood to rub in anything he could on anyone while he had the chance, "but weren't you on the Federation Penal Code—"

"Yes. The Revision Committee. You know I was, Benson, and when you get back here and people around the local Bar Association start asking you about it, you say you don't know who it was on that committee who suggested they drop prison breach and escape from jail from the code. At the time there hadn't been one for a hundred years and it was only reasonable—"

"It was reasonable," said Benson and looked over the top of the visiphone at Schwab who seemed angry about something. ■

testing . . . one, two, three, four

Naturally the best kind of test is the test that you don't know is a nice, fail-safe type of experience.

STEVE CHAPMAN

Illustrated by Leo Summers

Colonel Rafferty was surrounded by a computer. And he felt it. Little orange lights were staring at him. Plastic buttons were shouting orders at him. "Do not bend, staple, or mutilate." Feet on his desk, Rafferty fingered a heavy paperweight and thought dirt at the machine.

A private stepped into Rafferty's office with a sealed manila folder, paced briskly up to the desk, and saluted. "Sir, is this the MaCoApTe computer terminal?" The colonel winced again at the ridiculous designation and nodded. The private stared around the room. "Major Dell would like to know whether the computer can be ready to test a new applicant by thirteen hundred hours tomorrow. This dossier has all the new man's data."

"How would I know?" Rafferty asked through a toothy smile. "I'm only a part-time office boy for the thing."

"Yes, sir," the messenger stammered. He put the folder on Rafferty's desk and left the room. The paperweight hit the door as it shut.

Damn these Cal Tech, career-trained recruits, Rafferty muttered in his mind. *Damn all applicants for the Mars base. Damn the Mars base and especially damn this monster and the punch-card generals who built it. When I was in the air . . .* The colonel's tight mouth relaxed momentarily, as he mentally put himself back into an F-104 cockpit. *. . . we told the jet what to do. No glorified instrument panel ran the show. We held those turbines together with spit and rubber bands.* He recognized the cliché and went on. *I held my men together, and if those IBM four-stars had a brain between them, I'd be on the next transport to that base. But they won't even let me run myself through my own department.*

Captain Gilbert arrived five minutes later in fatigues. The colonel showed him to his testing chamber,

which had been prepared by orderlies under a white-coat's supervision according to personalized specifications from the monster.

Rafferty was sorely tempted to let Gilbert in on the secret. Gilbert's test involved "Initiative and resourcefulness under changing atmospheric conditions." But Rafferty had his orders. If Gilbert was fit to become a Martian cargo pilot, he'd have to prove himself to the computer on his own.

Rafferty sat Gilbert down in front of a video screen and read off the machine's typed instructions. "The testing computer has been connected to this room and to the viewer before you." That was true so far. Rafferty recited the lie. "Your test will be to watch a synthesized three-D film sequence, to observe the hypothetical extraterrestrial life forms therein depicted, to study their movements and behavior, to determine the pattern, or patterns, of their actions and/or their relationships, to dictate your conclusions into the microphone grid at the base of the viewer, and to hypothesize the aliens' possible effect, or effects, upon the Mars base. That is all." That was not the real test. The real question was whether Gilbert would be alert enough to notice a build-up of exhaust fumes in the room, wary enough to try to escape through the door—which would be locked—smart enough to find the source of the fumes, and strong enough to fight off carbon monoxide drowsiness and block off the source. "Do you understand?"

"Yes," answered Gilbert, eager to concentrate on nothing but the screen.

The colonel smiled and turned on the viewer. *No,* he mentally corrected himself, *I didn't really turn anything on. I signaled the computer to begin.* The computer was never off.

Knobby, bulbous, spindly legged Martians began waltzing and cavorting with fuzzy, baggy, clawed

Martians. Gilbert watched intensely. It looked like a cross between a mating dance and a mass defecation to Rafferty. He turned away from the imaginary mountain range, left the room, and heard the door click-lock airtight. It galled him that he was so conspiratorial with the monster. The monster, his boss.

Then Rafferty set up Private Second Class Dodges in a room where he would defend himself against hypnotically created beasties. Meanwhile it was Sergeant Harrison's job to convince a feline alien,—actually the computer's robot—that he was an intelligent being. Then he'd have to talk it into signing a peace treaty, assuming he could learn the alien's language. The computer knew he would fail. It would grade him on his attempt. Rafferty was going to hate to see the robot junked after the test. He had taken great pleasure in teasing the computer's mechanical pawn.

Colonel Rafferty put his feet back on his desk with a sigh. The monster spat a file card at the back of his head. He read the card:

FEET OFF THE NEW DESK. THAT'S THE THIRD TIME TODAY.

The colonel hurled a shoe at one of the thing's cameras. It teletyped its reply:

NEWS ITEM: JANUARY FIFTH: *STARS AND STRIPES* PERIODICAL: QUOTE: GREATER PENALTIES FOR DAMAGING GOVERNMENT PROPERTY. UNQUOTE

Rafferty put on his shoe, cursing flagrantly. He fed the new applicant's data into a scanner and then settled down for a nap in his swivel chair. With his feet on the floor.

The last thing he heard before he dozed off was a blare from a speaker. "I'll-buzz-you-when-I'm-through-with-Gil-bert." It always had trouble with names. It still couldn't say, "Polakowski." That amused the colonel no end.

"Good night, Polakowski," he said sweetly.

"My-name-is-not . . . klk . . . mmzzzz . . ."

Ten minutes passed.

He woke with a start. Even before he opened his eyes, he knew that there had been no buzz, but the computer had done something. He opened his eyes, and there was no light. Then he knew what was so wrong. The monster was dead. The office was finally free of the machine's quiet hum. There was no occasional clicking. The console lights were out. There was nothing but silence and dark.

His phone was dead. A power failure. A double failure, since the auxiliary power hadn't cut in. An attack? There was no point worrying about that. A frighteningly more immediate danger had occurred to him. It was good that he thought of it quickly.

He bolted from his chair, ran for the door, stumbled over his paperweight, and went sprinting down a pitch-black hall.

He passed Harrison standing in the doorway of his testing chamber with a cigarette lighter burning in his hand. "What's going on?" yelled Harrison. "My robot went dead!" Harrison at least was O.K.

Dodges and Gilbert were another matter.

They were locked in.

Rafferty heard Dodges's screams all the way down the hall. The private's questionable mental stability was being more than examined by now. It was threatened.

As Rafferty pounded down the hall, he made out that each scream was a word. One word, over and over. "Spiders!"

Pulling at Dodges's door, Rafferty decided that saving Dodges from the computer's nightmare took priority over seeing whether Gilbert was in trouble. But the door wouldn't give way without a signal from the dead computer.

Rafferty jumped onto a folding chair and put his face up to the air vent above the door. His best hope was to talk Dodges out of his hallucination. The lifeless computer wasn't going to snap him out.

"Dodges? Dodges!" The screaming stopped suddenly. Was Dodges's name enough to pull him back to reality? "Dodges, are you all right?" Silence grew into moaning, then into whimpering and a shriek. Rafferty spoke soothingly. But soon Dodges was a screaming maniac again.

Private Dodges couldn't hear the voice. His mind was the slave of a silenced machine. Rafferty started again, speaking mechanically in imitation of the computer. "Private - Second - Class - Dodges — your-test-is-completed." Silence. "Do-you-hear-me?"

The answer burst from a throat clogged with unseeable webbing. "But the *spiders!* The *spiders!*" Dodges was rolling on the concrete floor—or was it sand, or rock, or what to Dodges—trying to crush a few of the hundreds of creeping bugs that streamed from his mind onto his crawling skin.

Rafferty shut out the pitiful weeping and tried to think. The maddening thing was that Dodges could unlock the door from the inside, *if* he were oriented. What signal would the machine use to bring a man out of a trance? Rafferty made a buzzing sound. No good. He snapped his fingers. No good. Probably a pattern of flashing lights would release Dodges, just as flashing lights had hypnotized him. Rafferty didn't have lights. Damn.

"Dodges - try - to - remember - what - I - said - would - happen - to-make-the-spiders . . ."

Suddenly Dodges was hurling himself into plaster walls—or were they mountains, or webs, or what

to Dodges—and bellowing pain through spiderstung lips. Now his word-scream was, "No!" Obviously the word "spiders" was an enemy to his sanity.

Rafferty tried again, face against the vent, straining to maintain a mechanical tone. "Dodges-what-is-the - signal - for - your - test - to end?" The secret was sunk far too deep into Dodges's spider-blind eyes. He could only pull tarantulas from his hair. "Repeat: What-will-tell-you-when-your-test-stops?" The answer was bound too tight under Dodges's spider-itching skull. He could only crush black widows between his nails. He could only eat the wolf spiders on his lips.

Harrison walked up to Rafferty and said, "What is going on? I can't get out of this sector. The elevator's scanner won't accept my Security pass. Sir, who's in there? What are you doing?"

Rafferty looked at Harrison. "I'm thinking."

Harrison shut up.

Dodges was still a little-boy madman. Spiders were his child-fear, his just-one something-in-the-dark fear. And a dead mechanical brain had scanned a psychologist's report and stolen his dream secret.

And what can fight a nightmare? A dream makes up its own rules. Who, or what, could wake the staring lunatic with the shadow-creepers inside his eyes. Private Second Class Dodges couldn't. Colonel Rafferty couldn't.

"Momma!" shouted the voice from beneath a mountain of thin, black legs. But still the spiders poured down from the sky.

The colonel yelled. "This is Colonel Rafferty. Your superior officer. I order you to be silent."

The little boy cried and cried.

And then the colonel asked a question. "What color are the spiders?" He had said the taboo word.

For a long time, Dodges cried. Then he managed to say, "Some black."

"And some what, Dodges?"

"And some brown."

"And what size, Dodges?"

"All different."

"And what shape?"

"Legs. Long legs," said Dodges in a trance.

"And how fast?"

"I don't know."

"And what size?"

"Little," said Dodges quietly. "And some have hair. And I see one with red rings on its legs." He sighed. "Three rings on each leg. But four on each hind leg. Rings about a centimeter apart. Wine red." The spiders were real now. Dodges was crushing the fantasy under his foot.

"How many legs do they have?"

"Six."

"Spiders have eight legs," said Rafferty. And he said it very calmly, very gently, so as not to tear the man's mind, so as to bring the mind in for an easy landing.

Dodges said, "Then . . . these

aren't . . . spiders." And he fainted. And he slept.

"Harrison," said Rafferty, grabbing the cigarette lighter.

"Yes, sir."

"Stay with him." And the colonel was sprinting down the hall. There was Gilbert to think of.

Gilbert, behind a locked door with an unbreakable, frosted window. The colonel pounded on the glass. "Gilbert!" No answer. Maybe Gilbert wanted to concentrate on the viewer and thought that the pounding and yelling were one of the computer's tricks. Or he was unconscious, overcome by fumes seeping from an unseen tank with an open valve which the computer hadn't closed. Or he was dead.

Rafferty grabbed a fire prevention crowbar and started swinging at the glass. Four blows. The window cracked. Five blows. The floor was covered with fragments. Seven more blows. The window was clear. Rafferty climbed through and started coughing.

He stumbled over Gilbert on the floor in a heap. Gilbert had started to remove his shirt, before he passed out. Possibly he had wanted to make a mask of cloth. Now he was wheezing for breath, but alive. Rafferty would have to seal up the source of the fumes himself. If he didn't, everyone in the sector would be gassed.

But he didn't know where the fumes were coming from. He hadn't bothered to read the computer's report fully. He staggered to the air vent and sniffed. No. Not the obvious source.

He walked around the room, watching the flame of the cigarette lighter. As he approached the viewer, the flame shrank. The source was somewhere near.

Where? A vent? A grid. The microphone grid. A quick sniff proved out the theory. Rafferty reached for the grid and got a tooth-jarring electric shock. The computer was tricky. When Rafferty cleared his head, he understood why Gilbert had wanted a shirt.

Stripping off his coat, coughing violently, woozy from monoxide, Rafferty picked up the crowbar. Using the coat for insulation, Rafferty pried off the grid with the crowbar. Then he used the crowbar to stuff the coat down the pipe which had been behind the grid, poisoning the air.

Finally he pulled a fire hose into the room and flooded the pipe. No bubbles were escaping from it. The fumes were sealed off. Gilbert was breathing more and more easily.

Still coughing, Rafferty trudged back to his office to wait for someone to reinstate the power. Funny how the grid had been electrified, even with the power off. It must have been connected to a battery. Odd.

Dodges was snoring softly. Harrison was still bewildered.

Feet on his desk, Rafferty gloated. The machine had failed, blew it, fouled up, deserted. Colonel Rafferty had succeeded, saved his men, saved the day. The monster was dead. The man was triumphant. The computer couldn't be relied upon. He, the man, was superior. He, the man, had prevailed. He . . .

The lights came on. The machine was alive all around him. Humming, chattering, buzzing, bewildered by its coma.

So what. The colonel had proved his worth. Now the brass would *have* to let him become an applicant for Mars base duty.

He started filling out his recommendations for the men. "Recommend: Retest Gilbert. Pass Dodges. Fail Harrison. Basis: Pure intuition." No one read his recommendations, but he was required to put them in his file.

The teletype started clacking. Probably asking what was going on. Sweating hard, Rafferty chuckled and read.

MEMO: COLONEL RAFFERTY: WITHIN TWO DAYS, YOU WILL RECEIVE PAPERS FOR REASSIGNMENT TO ADMINISTRATIVE GENERAL'S POST AT MARS BASE #1. MY RECOMMENDATION— I. E. ORDER—HAS BEEN SENT OUT. YOU HAVE PASSED YOUR TEST.

click

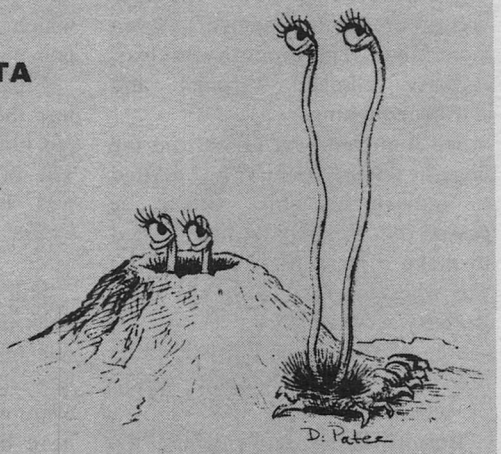
DAMN YOU.

Colonel Rafferty pulled his mouth tight and picked up that paperweight. ■

DEPARTMENT OF DIVERSE DATA

THE AMPHIBLEP
or "PEEK-A-BOO"

E.T. from Aldebaran II.
Rarely seen,
for he is very shy.



There was a very noisy hullabaloo recently when the Army sold some containers of liquid phosgene, $COCl_2$, to an Eastern chemical company, shipping it across the midwest by rail. One company bought the containers for use as containers; another bought the contents for use as an industrial intermediate for synthesis of dyes, drug basics, et cetera.

"A Rose By Any Other Name..."

The basic cause of the uproar was that the phosgene was sold by the *Army*, and it was identified as "a war gas from WWI."

Now it happens I live in a New Jersey suburb of New York City, through which passes the main line of the New Jersey Central Railroad; for years I took that line into New York City, crossing the Pennsylvania Railroad in the center of Elizabeth, New Jersey—which is one of the nation's larger cities—a fact that gets obscured by the happenstance that it's lost in the immensity of the New York Metropolitan area.

Having some chemical background, I've been interested in watching the huge tank cars, carrying tens of thousands of gallons, go rolling through, loaded with various important industrial chemicals. One particular train I recall—a total of about one hundred cars—contained four successive cars of liquid chlorine, two of liquid sulfur dioxide, two of liquid ammonia (*not* ammonia water), and one of liquid hydrogen cyanide. I was quite fascinated considering what could happen if that train got into trouble as it passed through the downtown area of Elizabeth.

Chlorine is used, of course, in immense quantities—fortunately the supply is effectively inexhaustible, since it comes from salt—to purge water of its more dangerous and offensive bacteria. And, of course, as an invaluable and irreplaceable industrial chemical raw material.

Similarly ammonia and hydrogen cyanide are invaluable and irreplaceable chemical agents. Formaldehyde in tank-car lots is offered by several major chemical producers.

Now the table of toxicity of vapors and gases published in the

Chemical Rubber "Handbook of Chemistry and Physics" lists chlorine (which was the first toxic gas used in WWI) as slightly more toxic than phosgene, but both are toxic in dilutions of one part per million in air. Formaldehyde isn't as bad; it takes three p.p.m., and hydrogen cyanide is practically harmless, requiring ten p.p.m. while ammonia requires 100 p.p.m.

However, phos*phine*, PH_3 (NOT phos*gene*, $COCl_2$) is used in some standard industrial chemical operations because it undergoes reactions that nothing else can provide; it rates 0.05 p.p.m. toxicity, twenty times as poisonous as chlorine or phosgene.

Incidentally, while nitroglycerin is best known for certain other chemical characteristics—it rearranges readily into more stable molecules—its vapor makes phos*gene* and chlorine seem harmless as as the morning dew by comparison. It's twenty times as toxic—just as a vapor in air—as either of those "war gases."

And then there's acetic acid vapor, the vapor of vinegar's acid, that is, actually, about as poisonous as hydrogen cyanide, and ten times deadlier than ammonia.

All things considered, it's obvious that the shipment of phosgene was not, in fact, particularly dangerous; we've been shipping immensely greater quantities of chlorine all over the country for a good many years, with no vast publicity howls of "war gas" shipments.

Yet chlorine was the first gas used in WWI, it's just as deadly as phosgene, and because of its great chemical corrosive power, somewhat harder to contain. (Chlorine dissolved in a little water can happily chew holes in gold, platinum, stainless steel—almost all metals yield to it. (Titanium is one of the relatively few exceptions, which is one of the things that's making Ti useful in chemical engineering equipment.)

Yet solely because there's been a different kind of publicity, chlorine's "public image" isn't so villainous—while phosgene, which is actually somewhat less deadly, yet equally useful in chemical industry, is a scareword name.

When rational men, with a full understanding of the actual facts in a situation, make a reasonable and practical decision to ship a material no longer useful in one area, to a place where it is needed —a howl of anguished horror goes up solely because of the name association.

I suggest we rename the stuff "carbonyl dichloride"; the news media people would never have recognized it under that name, and would simply have learned the true facts when they inquired (if they bothered!): That a useful industrial chemical intermediate in the Army's stockpile had been declared surplus, and was being sold.

What's needed is either more

ethical honesty in the news media, more chemical education, or less news-hungry hysteria.

If they start trying to ban the shipments of chlorine—slightly more deadly, another WWI "war gas"—the results should be very hysterical indeed. Polluted water would abruptly be *very* polluted; the price of such familiar commodities as chloride based plastics—floor tiles to squeeze-bottles!—would skyrocket.

As usual, a little knowledge—and a misunderstood name!—is a dangerous thing.

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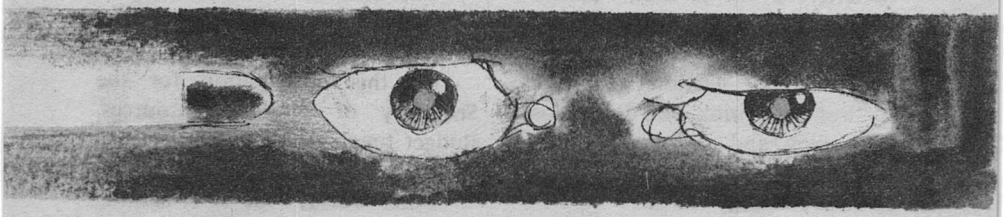
(Signed) Robert E. Park, Business Manager

SUPERIORITY COMPLEX

Finding Superman can be very difficult if you don't know what to look for and he doesn't want to be noticed . . .

THOMAS N. SCORTIA

Illustrated by Leo Summers



For the first time in a week Dalton felt the frustration of the search, the utter pointlessness of what they were doing. He turned from the elaborate charts of the presentation, the intricate DNA structures with the statistical gene-sorting arrays and slammed the pointer to his desk.

"It's no use," he said. "It's absolutely no use."

"Of course it is," Les Caldweil said. "We've spent half a decade on this project and more money than I'd like to remember."

"Do you honestly believe in it?" Dalton demanded.

"Complex 'X'?" Caldweil shrugged. "It's an article of faith with me. I've backed you and the survey team on this for five years. You tell me that somewhere in the gene structure of what's left of the human race there is the seed of an unknown genius and I have to believe it."

Dalton sat on the edge of the polymorph desk feeling the soft flowing corner bite into the flesh of his leg. Five years ago it had seemed so certain.

"The Secretary'll never buy it, Les. You know how tight funds are this year. There's no room in the budget for anything so wildly speculative."

"We've got to have the money," Caldweil said. "What do we do with all this?" He gestured widely at the room with its functional furniture

and its too-neat charts glowing from softly lighted walls. Beyond this were the offices, the laboratories, the banked computerized files of the bureau of what Caldweil called "the search."

"I'm tempted to scrap it all," Dalton said. "More than once I've told Trudy that I'd be better off back at the university. Perhaps I could get something done there."

"I hope Trudy had sense enough to talk you out of that," Caldweil said.

"My wife is the sensible member of the team," Dalton said wryly.

"But you think you'd be closer to finding and defining 'Complex X' if you weren't part of this structure."

"I'd be working instead of preparing pretty charts for the Secretary of Human Resources to demonstrate a concept that he should be able to get from our reports."

"It's the personal touch, you know," Caldweil said. "Besides, your job is conceptual and administrative. We can find a hundred bench men to do the research. We can't find a dozen like you. You conceived of the project, deduced the existence of Phil Jason—"

"I wish I'd never heard the name of Phil Jason, whoever that misshapen devil was," Dalton said.

"You found him," Caldweil said wryly. "You're stuck with him."

"Phil Jason blew out his brains a century ago," Dalton said. "Perhaps he knew what he was doing."

After Caldweil had left, Dalton screened his wife. "Trudy, sweetheart," he said. "I can't make it home for lunch."

"Oh," her voice said. She looked small and very disappointed in the viewscreen. He marveled at her youthful features. Why, she would be forty-five in another week. He reminded himself to send flowers and book the seats for the mime show.

"Oh, that's too bad," she said. "I was planning something special for lunch."

"It's this presentation for the Secretary of Human Resources. Budget time, you know, and we've got to dance for our supper."

"Don't worry," she said, smiling brightly. "He knows how important your work is."

"I wish I had your confidence," Dalton said.

"You'll see. Everything will turn out just right. I'll witch it for you."

"Do that," he said, laughing at the private joke. "I'll see you tonight. I'll be late."

"Never mind," she said. "Supper will keep." She blew him a kiss as the image faded.

For a moment he felt young and coltish. After fifteen years she still made him feel like that. Very masculine and assured beside her, very much the captain of their lives and destinies. That was her special appeal, that she did not try to gobble a man up like many of the amazons his friends had mar-

ried. If it hadn't been for her and his need to be something for her, he might have ended up his life in some obscure university lab working on a penny-pinching government grant. Instead there was Phil Jason . . .

Phil Jason who had lived a hundred years before in the middle of that fantastic jungle they had called Hollywood and had wasted his tortured life in dribbles of talent and insane flashes of insight. Phil Jason who had killed himself after siring two illegitimate children, who had stumbled into the world and diluted his precious germ plasm in a hopelessly profligate manner.

There was incredible genius stuff in the race. Call it "Complex X". Call it Phil Jason. It was there, wildly diffuse, waiting segregation and recombination, if indeed the task had not already been accomplished naturally.

He lowered himself into the foam chair at the desk and stared at the illuminated charts with their too-pretty reductions of complex patterns. Just like Jason's Hollywood. Too simple, too elegant, too unreal.

"Damn Phil Jason," he thought bitterly. "Why couldn't he have led a normal life, been more sane, more—"

Sanity for a superman?

In that madhouse?

It was a wonder, Dalton thought, that he had lasted long enough to have two children before he shattered that not-to-be-duplicated brain with a lead slug.

The Secretary arrived at two o'clock, almost an hour late. By that time the staff was restless and the work of the day had become completely disorganized.

"I'm sorry," the Secretary said with his widest smile. "One tries to fit one's life to a schedule, but—"

He waved his hand indecisively and Adler, his aide, said, "Of course, we'll have to amend the agenda somewhat."

Caldweil smiled and said, "We had planned a tour of the facility, but—"

"To be sure," the Secretary said, "but let's get to business first."

In the board room, they seated themselves and coffee was served. Caldweil made opening remarks and turned the briefing over to Dalton. After some moments of explaining the concept, Dalton was interrupted.

"What you are implying," the Secretary said, "is that this Phil Jason was something unusual, that his germ plasm, if it survived the Great War, is of special interest to us."

"That is exactly it," Dalton said. "Jason was unique, completely unusual in a number of striking ways."

"But how can you say this? Records are incomplete from that period."

"Our extrapolative methods are very subtle," Caldweil volunteered.

Dalton tried to silence him with a stare.

"We have the original clues. Our studies started some years ago, oddly enough as a result of a twentieth-century cultural analysis in the Federal University Humanities Department."

"Oh, come now," the Secretary said.

"It is hard to believe," Dalton admitted. "Jorgenson and his students were attempting a psychosympathetic analysis of some surviving films and cartoons when they happened across this single animated cartoon. It's really rather simple and naïve—you can see it later in the projection room—a simple plot revolving around a black sheep ejected from the flock under the shepherd's eyes . . . a little comic character named Trippy who was featured in these releases . . . and the revenge wrought on the flock, and the ram heading the flock by the ousted black sheep. It has a rather weird flavor, totally unlike anything being produced in the period."

"And from this you deduce the structure you call 'Complex X'?"

"Well, that was only the start, the first clue. Jorgenson and his people brought it to me and I began to check out several other pieces associated with Jason. It became rather obvious. The man thought in a different way. Subtly but definitely his thought processes, his creative processes were quite alien. We began to check into his life. It was a raging terror. Divorces, scandals, two periods in a sanitorium."

"He sounds like the least likely superman I've ever heard of," the Secretary said.

"But there are documented instances in which we found references to X rays. He was different physically. We know his circulatory system was abnormal. We have a biopsy report showing his cell structure was abnormal, polynuclear. But the most striking thing was his mental potentiality. The man was clearly a genius, and our computer program deduces . . . well, talents like emotional empathy bordering on telepathy, other traits less well defined that suggest he might have seen physical reality in a way we do not. Surely that alone would have made them think he was insane."

"The whole purpose of the Department of Human Resources," the Secretary interrupted, "is to identify the genetic resources remaining to the race after the war and to try and segregate and propagate the desirable racial traits that may be lost. I fail to see that you have proved that there is any genetic material that may be lost to the race."

"We know Phil Jason had a son and a daughter, both illegitimate,"

Dalton said. "We know they had children, and we know the genetic traits that made up Jason's uniqueness have been spread through the race. Perhaps they have recombined to produce another unique individual. If not, it's up to us to identify and assemble the complex, to recreate Phil Jason."

"Well, surely if these traits existed and were segregating themselves," the Secretary said, "we should have no trouble identifying them."

"You would think not," Caldweil said, "but where would you look?"

"Why, in the cultural leaders of the world, in the political and scientific leaders—"

"We've tried that," Caldweil said. "We've examined most of the genetic charts of the leading men of the past three generations and then—"

"Nothing," the Secretary said. "I'm well aware that you've found nothing. However, I have not been completely out of touch with your work. I've had my own staff looking into the project."

Here it comes, Dalton thought. Here it comes. He was not prepared for the next statement.

"You know," the Secretary said, "you haven't really done your homework well. Are you aware that Phil Jason wasn't Phil Jason?"

"I don't understand what you mean," Dalton said.

"The old script can be misleading," the Secretary said. "Your superman's name was not Phillip but Phyllis. You know, Phyl with a 'y', not an 'i'."

"You can't be serious," Caldweil said, half-rising to his feet.

"I am indeed," the Secretary said laughing. "My staff has definitely established that your 'Complex X' was a woman script writer in Hollywood. Indeed, she did have two children and indeed did end as you say, but . . . well, it is a rather silly mistake, isn't it?"

"Yes," Dalton said tiredly, "yes, it is a silly mistake."

After it was over and the Secretary's party had gone, Caldweil said, "That tears it."

"No more money?" Dalton asked.

"No more money."

"Well, at least I can get back to some serious work," Dalton said.

"I'd better start scouting for a job," Caldweil said. "I don't have your research talent."

"Still, this explains a number of illusive problems in our inability to identify certain dominant genes—"

"I don't understand."

"What if they're sex-linked?"

"Well, perhaps you have the chance to find out now."

On the way home, Dalton realized that he felt relieved. He had never been really happy as a government scientist supervisor. Now he could do some work again, perhaps follow up this clue. Of course, if the major characteristics of the

complex were linked with two X chromosomes, if the trait could only appear dominant in a female . . .

He was silent through most of dinner.

"Is it that bad?" Trudy finally said.

"No, sweetheart," he said. "Actually things are working out very well."

"I had lunch with Betty Adler today."

"That's good," he said.

"She's going to be living in this area now. Her husband's in government."

"That's fine," he said.

"You haven't heard a word I've said, nutty."

"I heard every word," he said kissing her.

She brought coffee into the study where he had retired to work after dinner. He had brought home several of the monographs he and other members of the staff had published in the early days of the project. It was strange, he thought, that the idea had never occurred to them. Well, why shouldn't superman have been a woman . . . poor harassed creature. He wondered what she had looked like. The appearance of Phillip Jason had never been of great interest to him. The appearance of Phyllis Jason was another matter.

His musing was interrupted by the crackling of the intercom. "I'm sorry," Trudy's voice said. "I know you didn't want to be interrupted, but it's Les Caldweil."

"Tell him I've gone to bed," he said sourly. Then, "No, never mind. I'll talk to him."

"You'll never guess," Caldweil said. His voice was filled with gloating.

"Don't play games, Les," Dalton said.

"Don't ask me how it happened, but we're in the chips."

"Damn it!" Dalton exploded.

"No, it's no joke," Caldweil said. "The Secretary called me himself. Just fifteen minutes ago. They're renewing and expanding the project."

"I don't believe it," Dalton said with a sinking feeling.

"We're all safe for another four years," Caldweil gloated. "The Secretary mumbled something about Adler convincing him we needed more time—"

"Adler? Who's Adler?" Dalton demanded.

"His aide. You remember his aide, the thin chap with the built-in snear. That doesn't sound like what I'd expect from him."

"No," Dalton said. "Perhaps someone got to him."

"Celebration's tomorrow. Lunch on me," Caldweil said. "Good night."

As he prepared for bed, Dalton thought, another four years. Endless papers, all the time-consuming meetings, the forms, the endless paper of bureaucracy with no time

to think, to work . . . It was almost as if . . .

The thought crossed his mind. Trudy and her luncheon date with a school friend. Adler had she said?

It would be curious, Dalton thought. After they had darkened the room he lay awake thinking. Well, where would a superman hide if not at the center of power?

Look for the power centers of the world and there you find superman, making over the world in a new image, a safe image, only . . .

Superman wasn't a man.

"Trudy," he called out in the dark.

"Yes, honey," she said—bright, alert, waiting.

"I . . ." he thought for a moment. "I don't remember."

"You're sleepy," she said. "It probably wasn't important."

"No," he said. "It probably wasn't important at all." ■

in times to come

For the first time, Analog had its own Press representative down at Cape Kennedy for the Apollo 11 launch; since we are by no means a news magazine, we haven't a prayer of competing in time with the news media.

Our representative was Russell Seitz, an M.I.T. graduate student and long-time reader, who looked at things from a different angle. (And with a collection of Nikons, Questars and tele lenses.)

The cameras brought us our cover picture; a type-free version will be available for those who want one. The article was written up by a team of Ben Bova and Seitz. And the viewpoint not covered by the standard news media is simply (as the article is titled) "What Supports Apollo?" The cover—one frame of a series taken at ½-second intervals—shows Apollo 11 two-thirds of the way up the gantry on its tail of flame. But that's not what supports Apollo—

What supports it is some 20,000 men, "the largest NO SMOKING sign in the world," a series of football-field size parking lots covered with liquid nitrogen tankers—the things that are *not* so spectacularly visible and audible as the Saturn V bellows its way into space.

You know—"You push the button on the wall, and that's what makes the light come on." Oh . . . yes? You left out a few hundred megabucks of hardware in that explanation!

And there will be, of course, Part II of "In Our Hands, The Stars" by Harry Harrison.

Note that we now have *two* type-free color cover prints available at $1.50 each; the Kelly Freas painting of the submarine in the sky, and the new Apollo 11 take-off. *The Editor*

It's great to be the only nation that can play the new game — but when it's based on natural law . . .

any number can play

RICHARD LIPPA

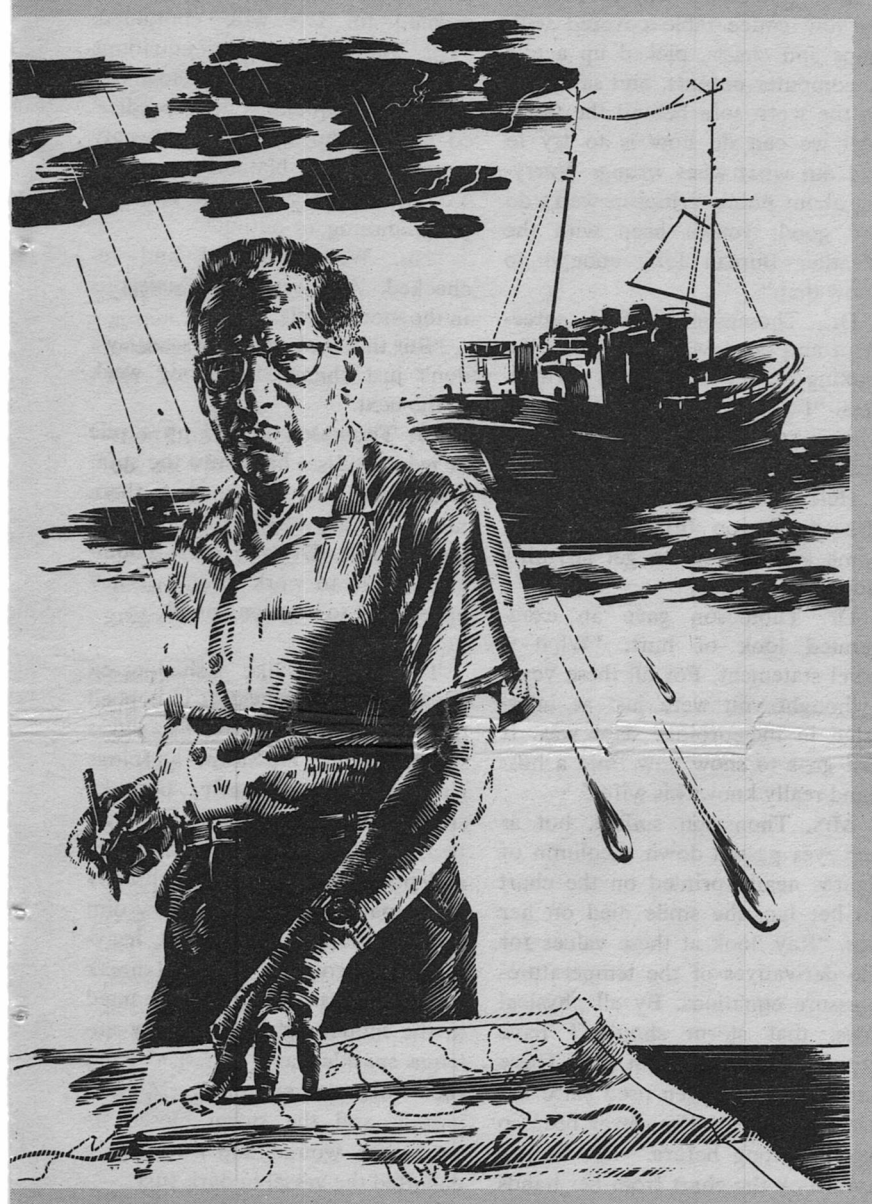
Illustrated by Vincent DiFate

"You know, in a way it's savagely beautiful," said Helen Thomason as she stared through the window into the obscure depths of the driving rain.

"Yes, it is." Dr. Raymond Thomason joined his wife. "It's so destructive, and yet it can be so beautiful." The limb of a small mimosa tree swung wildly just beyond the window; its leaves had already been torn off by the stinging lines of rain.

"I could sit here for hours, watching the rain pound on the pavement," said Mrs. Thomason rising, "but we have work to do."

"Unfortunately." Dr. Thomason frowned. "We're sure to receive hell for this. A hurricane slams into the East Coast after the computer simulation specifically predicts that it won't. People are going to scream at us from all sides, and what's our answer! That the simulation has worked perfectly for the past eleven months? I'm afraid that that's not going to count for too much now."



Mrs. Thomason walked over to the low coffee table covered with maps and charts, picked up a pile of computer outputs, and sat down on the worn sofa behind the table. "All we can do now is to try to find out what went wrong. Worrying about public criticism won't do any good; you've been with the Weather Bureau long enough to know that."

Dr. Thomason nodded agreement and sat down beside his wife, looking at her with mock seriousness. "I'm glad I married a woman who is smart in addition to being beautiful."

Helen Thomason laughed. "How else could you bring your work home and be sure to get anything done?"

Dr. Thomason gave an exaggerated look of hurt. "What a cruel statement. For all these years I thought you were just as interested in meteorology as I was. It just goes to show how little a husband really knows his wife."

Mrs. Thomason smiled, but as her eyes passed down a column of figures neatly printed on the chart on her lap, the smile died on her lips. "Ray, look at these values for the derivatives of the temperature-pressure equations. By all physical laws, that storm shouldn't have grown as quickly as it did. These equations have been used since the early Sixties; they've never been so totally wrong before." Dr. Thomason took the chart from her hands and looked at the column she pointed to. His wife continued, "The velocity-pressures equations follow the same pattern. How can differential equations that predicted so well during the past twenty years be so blatantly wrong? You're sure it's not an error in programming, or output?"

"No. We've checked and rechecked. Any error that exists is in the model itself."

"But this is absurd. Physical laws don't just change from one week to the next."

Dr. Thomason picked up a pile of maps and sat back into the sofa. "Assuming they don't, then there must be an explanation." With these words, Dr. and Mrs. Thomason began to work intently. They expected it to be a long night.

The ship was like a shadow on the torn, swirling water; it bobbed like a ponderous toy as waves slammed into it. Storm warnings had been posted early, but the small, squat fishing trawler had not fled; instead, it had moved slowly and precisely to a position directly in the path of the storm. Now dim sunlight shone upon the wet, heaving bow through a transient break in the clouds. The decks gleamed in the muted light; the silvery antenna sparkled as it emerged from the water-stained mast. Minutes passed, and the storm closed its temporary wound and once again engulfed the vessel in dark fury.

Through the background of shrieking wind and crashing water, a dull, buzzing sound wavered. Then, cutting through the water-laden air, a jagged, blue line of electricity shot from the mast to the seething sky above. It stopped almost as suddenly as it had begun. Once again the scene was that of a small fishing trawler lashed by solid lines of rain and tossed about by mountains of water.

Through the dark, obscuring torrents of rain, a flickering red spark appeared on the stern of the ship. At first, it rose slowly, tossed from side to side by the fierce winds. Then it gained speed and pierced the low clouds above. Through the howling of the wind a noise, similar to that of a cork popping from a bottle, echoed. Another spark appeared on the stern of the small trawler and rose to deliver its burden to the clouds above. And another spark flared and rose, and another.

It seemed as though the hurricane could not tolerate the ship stabbing into its heart with the spears of fire. The wind, hurling long daggers of rain, increased until the noise it produced was a steady shriek. Waves reached upward, as though trying to merge with the clouds, and then collapsed, crashing upon the ship. Forked blades of lightning stabbed at the ship, disappeared, and then reappeared as livid, yellow hands grasping for their victim. Raked by the vicious wind, the water surged and formed a swirling, towering mound that rose, and peaked, and crested, and then fell like a sledge-hammer upon the dark shape held within the flashing yellow hands. A cracking noise blended with the howl of the wind, and the ship broke into two pieces.

"Yes, this is Dr. Thomason." He switched the telephone receiver to his other ear.

"Dr. Thomason, this is General Shweiker. Dr. Williams has just told you all we know—from a technical standpoint, that is. The ship superficially appears to be a fishing trawler, but within, it's . . . well, I assume Dr. Williams has described the equipment aboard. God knows what would have happened if one of their ships hadn't wrecked and washed ashore.

"I've informed you as fully as possible. We deem it essential that you come down here and examine the equipment. Do we have your agreement to come?"

"Yes, all right." Raymond Thomason glanced over toward his wife.

"Fine. We'll have a plane waiting for you at Philadelphia International." The line clicked, and Dr. Thomason placed the receiver in its cradle.

"Who was that?" Mrs. Thomason looked up from her newspaper.

"That," said her husband, "was

the explanation to our problem. Get up, we're going on a trip."

"I'm not going anywhere until you explain to me what you're talking about."

Dr. Thomason explained. "The phone call was from Washington. It seems that a foreign fishing trawler wrecked in Debby and washed ashore near Wilmington, North Carolina. When the Coast Guard examined it, they found all kinds of strange equipment aboard, so they called in the CIA. Anyhow, the best guess of the smart boys who've already examined the ship is that it's built to tamper with the weather." He paused. "O.K., now you know almost as much as I do. They want me to go down and take a look at the equipment, and since you're my chief secretary and note-taker, you're coming along."

"Thanks a lot, Boss."

The plane lifted off the runway of Philadelphia International Airport less than an hour later.

"Now that you've seen it, what do you think?" asked General Shweiker walking next to Dr. and Mrs. Thomason. A salt-scented breeze flowed in from the Atlantic.

"Well, I'll need some time to analyze the information; however, I can give you some initial impressions: Obviously, the ship was attempting some type of cloud seeding. We'll know more about the actual method of seeding after we've

analyzed the contents of the missile heads. In addition, the ship used a high-voltage tracer beam; I'm not sure whether it's a sensory or cloud-conditioning device. Your electronics people will be able to tell you more about that in a day or two. I might add parenthetically that the ship was structurally reinforced; it was built to take the beating of a normal hurricane. However, even with reinforcement, it couldn't withstand the force of waves generated by two hundred and thirty miles per hour winds. The ship was so effective that it destroyed itself." He paused. "Do you have anything to add, Helen?"

Mrs. Thomason's long hair lifted gently in the breeze as she turned her head to her husband. "Only this: I would guess that the purpose of the ship was specifically to intensify, and perhaps to guide, tropical storms. In any case, there are probably many ships like this one in operation."

The three figures walked slowly toward the olive green car parked on the shoulder of the road that skirted the beach. They frequently paused as the general posed a question, and the Thomasons replied. Eventually they reached the car, with its stolid, uniformed driver. As they entered the car, the general leaned toward the Ph.D. and his wife and stated softly, "You realize, of course, that this information is strictly confidential."

Dr. Raymond Thomason and his wife, Helen, sat on the worn sofa in their workroom. Maps and charts were scattered on the low coffee table in front of them. Two weeks ago they had returned from the beach where the torn body of the trawler lay.

"They learn quickly, don't they?" said Mrs. Thomason quietly. On her lap was a map of Eurasia, covered with swirling isobars and bristly Beauford symbols. An unusually severe blizzard was forming over Siberia, and a strangely intense low pressure area was moving ashore from the Baltic Sea.

"Yes," said Dr. Thomason looking at the most recent southern Atlantic report. A tropical storm was rapidly intensifying near Puerto Rico.

"Ray," said Helen Thomason with a tone of awareness in her voice, "how often do things like this go on without our knowing it?"

"I don't know," answered Dr. Thomason, honestly. ■

P. Schuyler Miller

the reference library

RHODAN

We are told that the most popular science fiction here of all time is not Kimball Kinnison, not Tarzan or John Carter, not Buck Rogers or Flash Gordon, not Captain Future of revered memory, but an upstart who appeared only eight years ago in Germany—Perry Rhodan.

Rhodan's American press agent, Forrest J. Ackerman, reports exultantly that the Peacelord of the Universe—a title not yet justified in the American version of his exploits—is the hero of a *weekly* "complete novel." Internal evidence suggests that the three Rhodan books Ace has brought out to date consist of six—probably the first six—of these "novels." In addition, there are one or more paperback novels every month, hardcover books, comic books, and 500-odd Perry Rhodan fan clubs of which some must surely have their own fanzines. There is also a Rhodan film: "SOS From Outer Space." If it's humanly—or inhumanly—possible 4EJ will get it released on our side of the Atlantic, so watch your friendly neighborhood drive-in. It's likely to run in a kiddie show with the latest Andy Warhol marathon.

Perry Rhodan appears to have been created by a pair of German writers, Walter Ernsting and K. H. Scheer, but his adventures are now the work of a syndicate of the sort that ground out many revered juvenile yarns of a couple of generations back, and lent support to such American heroes as Captain Future (our own Rhodan), Doc Savage (thirty-nine paperback reprints of *his* exploits, last time I looked), the Shadow, and—to get out of the dead past—"Star Trek." Scheer

and Ernsting are credited with the first two Ace reprints, "Enterprise Stardust" (No. 65970) and "The Radiant Dome" (No. 65971). A new team, Kurt Mahr and W. W. Shols, was brought in for "Galactic Alarm" (No. 65972). (The first two books are 60 cents each; the third, in which the action has picked up a little, is 75 cents.)

The writers and publisher of the Rhodan epic seem to have learned a good deal from soap operas and comic strips. Very little happens very slowly, compared with the pace of a Captain Future or Doc Savage yarn, and the Rhodan team really does very little on its own. It serves as a focus for what action there is.

To sum up "what has gone before" as you pick up the next book in the series, Perry Rhodan is boss of the first crew to land on the Moon, some time in the early '70's. Since the books began to come out eight years ago, the authors can hardly be blamed for not naming their heroes Armstrong and Aldrin. At any rate, the *Stardust* has to be landed manually by Major Rhodan (what price prognostication?), but not because of rocks in the path—a wrecked spaceship, crewed by humans from a distant star, has brought it down with an interfering field.

Rhodan and his righthand man, Reginald Bell, get aboard the star ship and find that with two exceptions its crew is content to lie around, let robots feed them—presumably—and enjoy abstract art. They spend their lives stoned on culture. The exceptions are Khrest, a scientist dying of leukemia, and the beautiful but hostile Thora, commander of the Arkonide expedition, to whom the inhabitants of Earth are on the mental level of marmosets. (But wait, kids—Tarzan and Doc Savage became immortal, John Carter always was, and the Rhodan team are going to become supermen worthy of the haughtiest Arkonide.)

Taking Khrest back to Earth, where an Australian has a serum for leukemia, Rhodan lands in the middle of the Gobi Desert and proceeds to take on mankind. He declares himself a "Third Force"—I don't know why not a "Fourth," since the Chinese, Russians and the West are lined up against him. Mankind must abandon its plans for World War III (the Arkonides can neutralize nuclear bombs, as it happens—and do, in time). The admittedly realistic result is an all-out attack on Rhodan's base, which goes on and on and on, through book after book. The three rivals do pool their resources to destroy the Arkonide ship on the Moon, but not before Thora has joined the others. The attack triggers an Arkonide S.O.S., and as the third Ace book gets under way assorted nasties from all over the galaxy, hostile to both Arkonides and Terrans, are beginning to show up.

Rhodan is also assembling a private army of mutants with wild talents—telepaths, teleporters, time travelers, and one professional swindler who offhandly wrecks the world's economy to raise some petty cash.

There are some minor flaws that may be the original authors' or may be the fault of the American translator/editor, Wendayne Ackerman. For example, the escape velocity from Earth is not twelve miles a second and Australia spends dollars, not pounds, though it may have done when these stories were written. The English-speaking world calls "wolfram" "tungsten," and it's "Davis," not "David" Strait that runs up beside Greenland (that one may be a U.S. or German typographic blunder). Nor can I imagine a pair of Californians like the Ackermans standing still for a future super-freeway under the Sierras that's only sixty feet wide. In Germany, maybe—though I've heard that the *autobahns* were freeways before Los Angeles invented them.

It is the blandness of the Rhodan stories thus far that strikes an American as peculiar. It has been an axiom of American science fiction, and I consider it an axiom of good science fiction, that the hero goes out and does something. He tackles the rigors of a strange world. He solves a scientific problem. He discovers what makes an alien tick. Perry Rhodan, for most of these three books, sits around under an umbrella of Arkonide science and waits for mankind to see the light. However, the action is picking up in Number Three, and by the time this appears we may get a better idea of why Perry Rhodan yarns have been bought by fifty million people all over Europe.

THE CALIBRATED ALLIGATOR

By Robert Silverberg • Holt, Rinehart & Winston, New York • 1969 • 224 pp • $4.95

The nine short stories in this collection originally appeared in the regular science fiction magazines—the title story and two others here in Astounding. I suppose it is a slap in our collective faces that the publisher has assembled them for the delectation of the ten to fourteen-year-old group. All science fiction is juvenile, y'know.

Admittedly, these are not the new Silverberg. They are the old master who wrote rapidly, voluminously and entertainingly, and ate regularly thereby. Doing so gave him time to prepare himself for the nonfiction and serious science fiction he writes nowadays. So enjoy, enjoy.

To take the Astounding veterans first, "The Calibrated Alligator" is the story of the cryogenics man on a lunar base who managed to smuggle a baby alligator along with him. Then it began to grow—so one of his colleagues converted it into a test animal for an accelerated

growth experiment. And it grew even faster.

"Precedent," on the other hand, just may confuse the ten-year-olds —or their teachers. It is a sociological story about the axiomatic equality of races and the relative values of different societies. It is timely, in that it presents a parallel to the very present situation in which our troops abroad offend against local laws or customs. What is a broken law to a Leeminorran may not be a broken law to a Texan—so should he be tried? In whose courts? By whose laws and precedents?

"Point of Focus" is another ethnological puzzler. The Man from Vengo is trying to persuade the inhabitants of a world of chlorine breathers that it is to their advantage to join the galactic Federation. It isn't easy—and to make matters worse, he finds that a bunch of Terrans got there first. Terrans—who don't want any part of the Federation either. Question for a smart teacher to ask: do the undeveloped countries *have* to be like the U.S.? Or Russia? or Cuba?

Galaxy contributed two stories. In "Blaze of Glory" we have a very slight yarn with a lady-or-tiger ending. Did the Shaulans punish Murchison? "Mugwump 4" is more fun: one of those crossed lines that the telephone company is always arranging for us puts Al Miller—no relation—in communication with a bunch of mutant world grabbers from an alternative universe. Then there's this other bunch, the Normals. Familiar? You read it in 1959.

Science Fiction Stories (remember it?) contributed three yarns. In "Why?" we have an indirect answer to the question of why men go to the Moon, or fishing in Canada, or anywhere strange and uncomfortable . . . and why the stay-at-homes resent the roamers. "His Head in the Clouds" glamorizes the teen-ager who hijacks a Moon ship. And "Delivery Guaranteed" is a wild—and wildly improbable—one about a jerry-built spacecraft that is even crazier than Poul Anderson's beer-propelled ship of warm memory.

The last of the nine comes from *Fantastic Universe* and has a little more meat in it, plus some flat-out larceny. You've seen "The Artifact Business" in other anthologies, I'm sure. An "honest" archeologist has had to abandon his principles and pot-hunt for the export trade. And then he finds that, just like Mexico and Ohio and Egypt and many another place, the natives are making "antiquities" to order.

Fun, but nothing more.

TIMESCOOP

By John Brunner • Dell Books, N. Y. • No. 8916 • 156 pp. • 50¢

This is John Brunner having fun. If you don't insist that everything he does from here in has to be

like "Stand on Zanzibar" or "Jagged Orbit," you can have fun too.

We've had stories before about bringing noted people from the past via something like the Timescoop —but how many writers have taken time to point out how out of place such people would be in our world, let alone a future world? Brunner is a realist; he does it—with hilarious results.

Future tycoon Harold Freitas III finds that one of his hired hands has invented a kind of time machine. It is, incidentally, a brand new kind of time machine, which gives a wholly new rationale for bringing things through time without affecting history. Minor things like that John Brunner throws in for trimming. Anyway, Freitas decides to infuriate his principal business and social rival by throwing a party for several of his illustrious ancestors, scooped out of the past.

They are a varied and individualistic crew. Sieur Bohun de Freitas, a Norman knight in the service of William the Conqueror. Sir Godwin de Freitas-Molyneux, a valiant crusader. Reginald de Freitas, a composer of choral music. Edgar Freitas, a minor poet and hanger-on in the court of Elizabeth I. Reverend Ebenezer Freitas, a noted Puritan witch-hunter. Joshua Freitas, 18th century English "sugar" trader. Tabitha Freitas, Union spy in the Civil War. And Buffalo Hank Freitas, gunslinger and Indian fighter. Bring them all together—discover what the genealogist didn't put in his report—and you have chaos. What more do you want?

ISLE OF THE DEAD

By Roger Zelazny • Ace Books, N.Y. • No. 37465 • 190 pp. 60¢

Once upon a time telepathy, levitation, teleportation and other such phenomena were considered part of the realm of the supernatural—fantasy. John Campbell has probably done as much as any science-fiction editor to draw "psi" into the bounds of science fiction. As a result, stories like this, which deal with primarily mental powers, are now respectable SF—even when the hero calls himself a "god."

Francis Sandow was born in our century. Through physical science, molecular biology, psi—what have you—he has survived for centuries or even millennia. Tremendously powerful, tremendously wealthy, he not only terraforms planets—he makes them, landscapes them, populates them with creatures to suit his whims and fancies. Gradually, just as many great men of the past have taken on the characteristics of archetypes, Sandow takes on the image of the "god" Shimbo, Shrugger of Thunders—not a human archetype, but that of an immensely old, immensely advanced, immensely tradition-shaped race of aliens with whom men share the Galaxy.

And, of course, there are other

"gods" in the world—men and women and Pei'ans who have or have had powers and instincts like Shimbo/Sandow's. They are a greedy and jealous lot, even if a bored and weary one, and inevitably they feud with each other and with Sandow. The book is the story of the greatest of these struggles.

Zelazny hasn't repeated himself yet, and he probably never will. If you think this is "Lord of Light" all over again, you're totally wrong. Prove it for yourself.

TIME GLADIATOR

By Mack Reynolds • Lancer Books, New York • No. 74-537 • 192 pp. • 75¢

You may have read this here in Analog in 1964, when its title was "Sweet Dreams, Sweet Prince." The present title is a complete fraud. The story itself gives the peripatetic Mr. Reynolds a chance to show us some of the world that he knows so well, but he tends to stop the story in its tracks and fill us in on history, which he doesn't do any more.

Denny Land is one of those non-teaching, perpetually researching professors of history who are already with us. The 21st century, it seems, still has them. His specialty is the Etruscans, and the weapons and fighting methods of the ancient world. Through clumsiness he lets himself be trapped into fighting in the national gladiatorial combats—the Twenty-first century likes bloodshed just as much as we do, but *they* admit it. Through expertness, he is a winner. Then, overnight, he finds himself out of a job and inviegled into service as a spy, hunting for a hidden scientist in a Spanish village. And *that* suddenly develops into three-cornered carnage, with champions for the West, the Soviet East, and Europe fighting it out under the supervision of the World Court. And that is just the beginning.

INDEX TO THE SCIENCE FICTION MAGAZINES: 1968

New England Science Fiction Ass'n, Cambridge, Mass. • 1969 • 19 pp. • $1.00

This is the third of the annual supplements to NSFA's "Index to the Science Fiction Magazines, 1951-1965," compiled by Erwin S. Strauss. It covers all the English and American science fiction magazines published during 1968. Similar supplements are still available for 1966 and 1967 at $1.00 each, and the main index—itself a kind of supplement to the classic Day Index—for $8.00. Don't try to get them from your drugstore, or wherever you do buy books. Write to the New England Science Fiction Association, Box G1, MIT Branch Station, Cambridge, Mass. 02139. (Most of the NESFA members are or were MIT students.)

You get these things: an issue-by-issue checklist of the magazines

published and indexed during the year; an issue-by-issue listing of their contents; and separate title and author indexes. Unless you throw your magazines away, or give them away, or maybe sell them at a vast profit, these indexes are essentials.

REPRINTS IN HARD COVERS

Walker and Company, a small publisher which has had some good original science fiction in the past, has launched an ambitious program of all-out SF publication. The Walker 1969 list is notable for hardback editions of excellent books that Americans have seen only in paperback. (Many of them have been published in England.) There will also be occasional new editions of hardback books whose original publisher let them go out of print. If I have reviewed the previous editions here—paper or clothbound—I'll simply report them as they come out.

There will also be occasional new books, and those I'll review as I see them.

The reprint list, to date, includes these top-notch titles:

THE WHOLE MAN by John Brunner ($4.50). The striking novel about a powerful telepath, with which Brunner really moved into the field of major SF writers.

THE WATCH BELOW by James White ($4.50). A "generation ship"—at the bottom of the Atlantic.

THE MIDWICH CUCKOOS by John Wyndham ($4.50). A classic—all the women in an English village are impregnated by extra-terrestrials. Then their super-children are born. Lippincott did publish a hardback edition when it was new.

THE SPACE MERCHANTS by Frederik Pohl and C. M. Kornbluth ($4.50). Another classic, which needs no identification. There were simultaneous hard and paperback editions from Ballantine when it was first published.

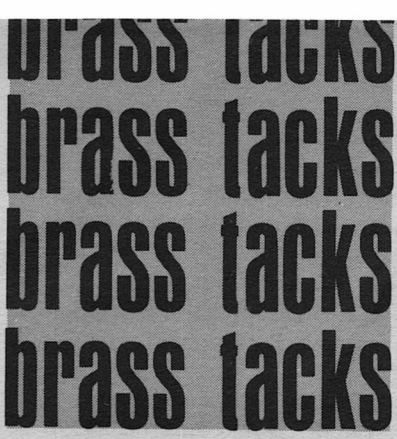
BRAIN WAVE by Poul Anderson ($4.50). "A world gone sane." What if we were all brilliant?

DRAGONFLIGHT by Anne McCaffrey ($4.95). How this missed original hardback publication I'll never know, but Walker has saved the day.

A CASE OF CONSCIENCE by James Blish ($4.50). Another landmark book, and one of the very few SF novels with a religious theme.

THORNS by Robert Silverberg ($4.95). The first novel by the "new" Silverberg—Chalk is a psychopath who delights in tormenting psychotics, but this "experiment" backfires.

BUG JACK BARRON by Norman Spinrad ($5.95). I've reviewed the Ballantine paperback. This hardbound edition seems to have been published simultaneously.



Dear Mr. Campbell:

The Demon Tobacco is indeed an 'orrible 'abit, but not because it causes cancer. It costs like h- to buy cigarettes for two, and it hurts plenty to lay out thirty bucks a month to indulge our craving.

What bugs me about the "Down with tobacco" campaign you wrote about in the July 1969 issue of Analog is the appalling neglect of proper research procedures in the *first* place. None of the subjects tested lived at the lab; they went home every night to their families. Consequently, when it was announced—ambiguously—that more smokers got cancer than non-smokers, *nobody* asked how come some non-smokers got cancer too, and *nobody* thought to ask if there was some other common denominator, since the teetotalers surely *didn't* get the disease from cigarettes.

Of course you can't lock men up in cages to make such tests, but because you can't, there are a million possibilities left out—the wife's lipstick, hubby's shaving lotion, some "fortified" food, or food preservative, air pollution, chlorinated water—gad, there's no end to them! All the things you put into your mouth, or breathe in. And the pity of it is that having completed one test series, the learned scientists were in a position to probe and follow out all the things the cancer victims in *both* groups used in common. Because, rely on it, the cause was *there,* and had only to be sought for and correlated. It wasn't.

Of course, my husband says that the test is no good anyhow if you don't follow it up at regular intervals on the same test groups. He says no effort was made to find out how many in both groups got cancer later—in ten or twenty years, the figures may well be the opposite, for all the researchers know about it. He's a lab tech in biological research, and he says a prime factor in such tests is being able to control temperatures, diets, and routines so that in all but the one phase being tested, all the test animals get exactly the same living conditions. And in *real* science, the proper method is regular follow-ups during the lifetime of the animals, on the look-out for after effects—often delayed into the second or third generation—and side effects that weren't expected, as well.

But man can't be caged or controlled, and worse yet, he lives too blamed *long*—why, the subject could well outlive the researcher! —so he's the worst possible test animal on earth, and any test made on *him* is incomplete and doubtful right from the start.

Well, man is exempt from good lab procedures, and that's that. But you'd think scientists and doctors, at least, would recognize the faults and make it clear to all concerned that the tests proved absolutely nothing except that nonsmokers *can* get cancer, too. Why, even *history* disproves the cigarette theory soundly; throat cancer existed long before any fool show-off *thought* of trying t› smoke the stuff!

Oh, the big shots aren't sticking their necks out too far. They reported only that "more smokers get cancer," and let the rest of us draw our own conclusions. They *never* said it *caused* cancer; in fact, they have often remarked that there are "probably other factors" as well. You bet your life there are! But when fame and fortune calls, it's easy to win by default and a little careful attention to semantics that only *infer*, yet never make a definite statement.

As a result cigarette taxes made the weed more costly than ever. Big Brother gently chides us on TV for endangering our lives with the stuff, and a lot of people are rapidly sold on the poisonous character of tobacco. Once, finicky women complained of the reek, and fussed about the curtains; now they glare angrily and demand that the poison be removed from their vicinity forthwith. You just *can't* beat folks like that with facts about research. But I've been trying!

GWEN CUNNINGHAM
1438 Corona Place
Walnut Creek, California 94596

Maybe cigarettes lead to chilblaines, ingrown toenails, and alopecia, too. That hasn't been investigated yet.

Dear Mr. Campbell:

Though I usually concur with the opinions expressed in your editorials, I must take exception with parts of "The Lynch Mob Philosophy" in the July Analog.

The points you bring up are, as usual, based upon a firm foundation of logic, but you overlook the basic problems cigarettes create. Whether the doctors, scientists and "learned lynchers" know what the tobacco smoker is really after, or not, doesn't change the fact that cigarettes are dangerous. Now of course, you can use one of your analogies to point out that cars are dangerous, too, and so is too much ice cream or an overdose of air. But that is actually evading the point. There is ample evidence to indicate that some element of smoking leads to cancer—or heart disease—and whether that is the element the smoker is after or not

doesn't make it any less dangerous.

I agree with you about the F. C. C.'s plan to ban cigarette advertising on the tube. This is wrong and unfair. But the general impact of your editorial seems to dismiss the obvious dangers inherent in smoking.

BRAD LINAWEAVER
3643 Lakeview Drive
Apopka, Florida 32703

It is not—repeat NOT—established that cigarettes cause the observed increase in lung cancer. There are too many other relevant—but studiously ignored!—factors present. Statistics can NOT establish a cause-effect linkage; only a correlation, unless the statistics reach the level of "ninety percent of those who do X die within twenty-four hours."

The evidence linking cigarettes and lung cancer is a damn sight worse than the evidence Dr. Rhine gathered on ESP—which scientists keep insisting is "just coincidence." Rhine's statistics are enormously more massive—but because they don't support a "we know the varmit's guilty" preconception, they are rejected.

Dear Mr. Campbell:

As public relations counsel for Resin Systems Inc., we received quite a surprise the other day when we spotted "The Simple Way" in your May 1969 issue, and read that you proposed as a possible Elegant Solution to the spacesuit problem "a shrink-fit plastic . . . that's put on swollen and limp because of a softening agent; as the agent evaporates, the plastic shrinks and hardens to a perfect skin-tight fit."

The reason for our surprise is that Resin Systems in the past few months has introduced just such a plastic. Called DIP'N GRIP, it has the capability of adding a "rubberized" coating around anything that is dipped into it—also the DIP'N GRIP can be brushed on. The DIP'N GRIP hardens within minutes, and unlike paint substances—can be removed easily by stripping.

Although DIP'N GRIP will stick to any surface like wood, metal, plastic, et cetera, I don't really know how it would work out on skin, so I wouldn't go trying it there until I talk to Resin Systems' laboratory chief.

DAVID A. WEISS
280 Madison Avenue
New York, N.Y. 10016

Sorry—it's a good product for what it was developed for, but not for that *job! To build up enough successive layers of the plastic to have the required strength would take days, not minutes. And it's good sealant—which means it is not porous. And the present solvent, the label says, is not good for skin!*

Dear Mr. Campbell:

Your recent comments on gun controls, capital punishment, and

other issues which arouse much ire these days may have missed out on one thing that makes legal systems effective. It isn't the drastic nature of a sentence, so much as the certainly of getting it, that deters.

Take England, where there was so much punishment for so little offense in bygone days . . . The English legal system is less a system of high-powered barristers than a method of finding out the score and doing something about it. They make mistakes, but they do have a good reputation.

Currently they have been piling up statistics on one offense against which the law has levied its muscles.* If you are checked for alcohol on the breath and they find any, you will walk or ride the bus after you get out of hock. Results? Nearly 1,000 less highway deaths, and about 11,000 less highway injuries since the tough policy started.

A similar policy applied to criminal use of firearms over here might do a lot more than prohibition-type laws, applied like the 18th Amendment.

Our legal system is one which seems to be getting more out of hand each day. Currently one lawyer is appealing his client's sentence in an Eastern state on the grounds that lack of air conditioning in the courtroom and the jail where the jury was quartered didn't allow his client a fair trial . . . This sounds like one of Kuttner's "Gallagher"

*D.W.I.

stories, which, oddly enough, was laid in this general time period. Whether the client is guilty or not does not matter, one assumes.

Odd note: Much of the gun crime in recent years traces to certain cheap pistols imported and sold in large amounts as cheaply as $15. Quite a few shooting sports writers wanted a ban on this class of firearms, but it was argued that We Needed New Laws. Did we? Last year while the 1968 Gun Control bill was in the works, a simple executive order to the State Department Munitions control board put an end to all imports of foreign guns for some time. No law, no wrangling. Just one simple order did it. The machinery *existed*, but for sake of argument had never been used.

A current import control system favors target and service type pistols, and bars pot metal pistolas. So the importers now import them in pieces. The Government is powerless, it says. No doubt they need New Powerful Laws. Or could they follow the precedent above? Maybe some day one won't even be able to ship standard hardware interstate if it could be or has been used in a gun.

By the same token, one should always swat flies with sledgehammers, to . . .

JOHN P. CONLON
52 Columbia Street
Newark, Ohio 43055

Our air-conditioned criminals seem

to have a "civil right" to be free as the air—no matter what they did!

Dear Mr. Campbell:

As I write this letter, our astronauts have returned safely to lunar orbit. It is reported that President Nixon will decide within the next thirty to sixty days whether the U.S. should aim for a Mars landing. Since most people do not bother to write to their elected representatives, a few thousand pro-space-program letters at this time might very well mean the difference between the continuation or termination of our space program. Therefore, I am writing this letter to urge all the readers of Analog to write letters to the President, their representative, and their two senators urging that the space program receive an immediate increase in funds and that the proposed goal of a Mars landing be adopted.

ROBERT HALFHILL
1017 Park Avenue, Apt. 307
Minneapolis, Minnesota, 55404

It sure wouldn't hurt space progress to do so!

Dear John:

I plead not guilty to the charge lodged against me by Matt Cartmill in your June issue—which arrived rather late in this country—of ignorance of the human anatomy around the mastoid process. Indeed, I know it all too well, having undergone a radical neck dissection in that area to extirpate metastases from a squamous carcinoma of the tongue. (That was five years ago, so apparently it was successful.)

Mr. Cartmill quotes my story "Skysign" accurately as saying that the device which my heroine had to remove was "under the mastoid process." This is simply a topological description; the device could be anywhere under the skin in back of the ear, and furthermore, I specified that it was small. But Mr. Cartmill emends my description to read, "an object lying *deep in* the mastoid process," (my emphasis), which is creating a difficulty which is not in my text. To cut out a small object lying under (not in) the mastoid process would not be easy, and I did not mean it to be easy . . . it was, after all, the act by which I showed that my heroine was fearfully courageous . . . but it would not be the major, delicate piece of surgery that Mr. Cartmill creates by misquoting me.

I am in fact a little disquieted to be accused of ignoring a biological point of this kind, for biology is the only science I ever practiced and almost all of my science fiction centers on it. If I'm not scrupulous toward that, I'm not worth reading.

JIM BLISH

"Under" can mean "nearer the center of the Earth" or "more deeply embedded!"

letting men land there safely, make observations, and escape again, is not to be expected in the near future.

So far, the Soviets have done the boldest job of studying Venus—and so far their best instrument package designs have collapsed before they could finish falling all the way through that stupendous atmosphere. If the heat didn't get 'em, the pressure did! Remember that a vacuum—no gas at all—is a good thermal insulator, and that the denser the gas, the better it can conduct heat. By the time the gas is up to some 1,500-2,000 psi, and at a temperature of 500-600°F. its ability to heat a set of solid-state electronic devices to destruction is not going to make the design of a successful unit easy. Add high speed and atmospheric friction, and the gadget is not long for this world! In addition to the appalling heat and pressure native to Venus, the thing has to dissipate its gravitational potential as it falls at something like 6+ miles per second into Venus's gravitational well.

It's not too surprising that even the carefully designed Soviet probes have collapsed under those stresses!

Manned probes to Venus are going to require developments of techniques and processes beyond our present conceptions.

Incidentally, the problem of Venus instrument probes may bring about a revival of vacuum tube technologies. General Electric some years ago developed a system of vacuum tube designs they called TIMMs—Thermally Integrated Micro Modules. The vacuum tubes were about the size and shape of a dime; a thin sheet of metal coated with metal-oxide material was the cathode, a thin circle of ceramic supported a sheet-metal screen grid, and another ceramic washer held the anode, a sheet of titanium, from that. Resistors and capacitors could be made of the same sort of ceramic-and-titanium structures; inductors were a bit trickier, but quite successful. These were stacked and arranged in a compact block—and the whole system operated in an insulated furnace! The system didn't heat the tube *cathodes* as in a standard vacuum tube—it heated the whole tube to the temperature that got the cathode working. The ceramic-and-metal components weren't in the least bothered working at a dull red heat, so the whole complex of logic circuits for computers could be neatly packaged in a small furnace!

Just the thing for a happily operating instrumented unit swimming around in Venus's furnace-hot, high-pressure atmosphere. Even down there, it might still

need a little thermal insulation to keep the heat *in!*

But the other planets? Mars will offer little problem to a technology that can land men on the Moon safely—once we get them out there!

Obviously, men aren't going to land soon on the giant gas planets, Jupiter, Saturn, Uranus or Neptune—but they may make landings on Pluto some day. Landings on those giants will come even later than landings on Venus; the temperatures won't be so much of a menace, but the pressure that turns hydrogen into a solid metal, *not* simply hydrogen snow, but a never-seen-on-Earth *metallic* form, is beyond the capability of ordinary structural materials.

Nevertheless, manned explorations will be wanted, because the moons of the gas-giants are decidedly first-class objects for inspection.

The Mars problem is the immediate one; when that's been solved, the others will be relatively minor matters of adaptation.

When Surveyors landed on the Moon, they televised pictures back to Earth very neatly, on command, and did various minor chores such as digging up moon-dust, making alpha back-scattering analyses, et-cetera, also under command from Earth.

I've been trying for some time to get an article on the work being done at M.I.T. on the development of MR Robot. MR Robot is Mars Rover Robot. The work's being done largely by a team under Louis Sutro, in cooperation with the Project Mac computer research team under Marvin Minski. The problem's a dilly.

Remote control of a robot on Mars is out; the signals take about a quarter hour to make a round trip. (The recent story "A Flash of Darkness," by Stanley Schmidt, was based on some of the problems of a Mars Rover.) The result is that the robot must be almost entirely internally self-controlled. Even a static robot like Surveyor, that just sat there and took pictures, or scooped up a little Martian soil and tried to examine for life traces, would have to be internally controlled, to keep the silly thing from violating Dr. Asimov's Third Law of Robotics: "Thou shalt not so act as to cause thine own destruction."

This is obviously the simplest of the Three Laws, and the one that will, therefore, be the first to be incorporated. Simple thermal overload relays in electric motors already represent one step toward the Third Law.

If we could just incorporate that Third Law into our automobiles, think how many lives would be saved! They'd refuse to try going fifty miles an hour on glare-ice slicked roads, would automatically cut out the engine when the driver

tried to drive faster than the headlight beams could reveal the road ahead, or allow a hypnotized driver to drive straight into a bridge abutment, or the back of a truck.

For MR Robot, the Third Law must *really* be incorporated. If it costs half a billion dollars to land the contraption on Mars, we do *not* want the witless collection of hardware climbing up the side of a crater, and happily proceeding over the edge of a 1,000-foot drop-off. Even under one-third gravity, this would not be good for the project. And with a fifteen-minute round trip for commands, even at light speed, remote control is out.

But this requires that the robot be able to *see*. Now a camera does not *see;* it records a pattern of light and shadow which human observers later *see*. When you say "I see what you mean," you're not referring to an optical phenomenon, and you don't imply that a camera could record what you "see". "See" means to understand the relationships presented.

TV cameras record a scene, but they don't see; the MR Robot must incorporate a computer mechanism that can understand and evaluate the relationships revealed by that pattern of light and shadow.

And that, dear friends, is an enormously difficult problem. How do you induce a robot to use stereoscopic electronic camera views of a landscape to recognize the difference between a boulder, its shadow, and a dangerous pit? You think it's easy? Hah! So you've got, built in, the results of three billion years of field-testing and trial-and-error—how many quintillions of living tries turned up "error" and died in those ages?—that works so smoothly you're not even aware it's going on. How many trillion individual living-cell computer elements do you use to distinguish—by moonlight, say—between trees and shadows on the grass?

The evolution of that highly sophisticated equipment has been greatly helped by the counter-effort of various animals to make themselves unseeable by camouflage. This put a prize award bias in favor of really competent computer systems and optical aids—such as color vision. The ones that could crack the camouflage efforts of prey ate better; those that could spot the camouflaged carnivore lived longer.

Nature has ways of producing new trial models that make the trial-and-error technique quite practical. Also Nature doesn't seem to mind waiting a half billion years while the problem's worked out.

At half a gigabuck a throw, we are *not* going to want to develop MR Robots by trial-and-error. And we don't have a half gigayear to wait for a working unit, either.

Now one answer to this, of course, is to use the already devel-

oped units, with already tested and proven competence. They're light, dependable, highly adaptable—and perfectly willing to take a risk on the trial-and-error business of making it to Mars and back. Men have all the characteristics hoped for in MR Robot, plus an unlisted number of others. One of the most important is the ability of self-repair, and the ability to operate in a useful fashion even after massive, serious injury. (Try visualizing a robot walking around on a crutch, or holding one end of a rope in its teeth because its right arm was broken.)

Now not only is Nature willing to use the trial-and-error method—she's built a willingness to accept that way of progressing into her products. Men *are* willing to take the risk for the gain.

Moreover, Nature's products have a degree of reliability ours have never approached. Take a look at an active and competent eighty-year-older and consider what technical device of even moderate complexity could operate for that length of time. And in many human cases—without any external repair or assistance.

Actually, the problem of getting human observers to Mars is not with the men, but the machines.

On a short-run trip to the Moon, we can use an "open cycle" life-support system. Their oxygen is used once, and spilled overboard. They use fuel-cell power supplies that consume hydrogen and oxygen, and dump the water produced. The men use that water—after they manage to get the blasted hydrogen bubbles out!—and dump it after one use. Their food they bring with them.

Their capsules leak gas at every seam; on a two-week or one-month mission, you can get away with that.

For planetary trips, we have to talk in years, not days. We can carry all the oxygen and water and food needed for a few days—but not for a few years.

The life-support system most often proposed depends for reliability on living cells; Nature's a great chemical engineer. A purely technical-chemical life-support system seems beyond our present skills.

And, as a matter of fact, even a biological system seems to be at the farthest limits of our present skills. Oh, the living organisms do all right; the problem is one of reliability of filters, pumps, lights, power supplies, and control systems. Earth's life-support system is all-organic, but with a stupendous inorganic reservoir that allows the organic systems to react slowly by negative feedback loops to rebalance the system. A forest fire that produces a billion tons of carbon dioxide doesn't embarrass the system, because of the sheer mass of the inorganic reservoir; by the time the forest has regrown, the balance will have readjusted by increased

photosynthesis of a trillion plants elsewhere.

Trace contaminants here on Earth are diluted to non-toxicity, while something, somewhere, finds out how to digest the stuff and use it up.

One experiment in a sealed-up closed-cycle life support system here on Earth at a research laboratory went very sour. Instead of the thirty days in the test capsule, the four men had to be rescued in five days. It took a couple of months to find out what it was that had poisoned them so severely they were violently nauseated, weak, trembling, and feverish.

The cause turned out to be a *very* trace amount of the vapor of a plasticizer used in the floor tiles of the test-area. Normally, the plasticizer—which has a *very* low vapor pressure—is able to escape in dilution in Earth's atmosphere. Sealed in, it built up toward equilibrium—and toxicity.

There are millions of individual components involved in the operation of a Saturn V-Apollo mission. If every component was 99.9% reliable—a very high standard of reliability for industrial production—there would have been 15,000 component failures in the Apollo 11 mission. With that 99.9% reliability the answer would have been "You are go for sudden death!"

It is that problem that has led to the "zero defects" campaigns—the effort to make components, systems, and complete units that have zero point zero zero zero defects.

How many components will be required for the Mars trip-and-return mission?

And on *that* mission, the units must not only work perfectly the first time—but *keep it up for many months.*

Mariner IV and VI and VII have reported on Mars; their cameras were not in action until the last few hours as they swung close by the planet.

The cameras weren't reliable enough to keep them in operation.

Whether manned or unmanned, probes to the outer planets will be up against the reliability problem, on top of the problems such as MR Robot design, or life-support technology.

Obviously, what's going to be essential is an internal self-repair mechanism of some kind, to compensate for the impossibility of absolute, indefinite-life mechanisms, whether the probe is manned or unmanned.

The only trouble is, Man is the only mechanism yet discovered that can understand the problems of, and repair the failures of, unmanned mechanism.

This suggests that the unmanned probe had best be designed to include a repair technician. Particularly if you hope to have it function on the long swing to Jupiter's moons and back.

The Editor.

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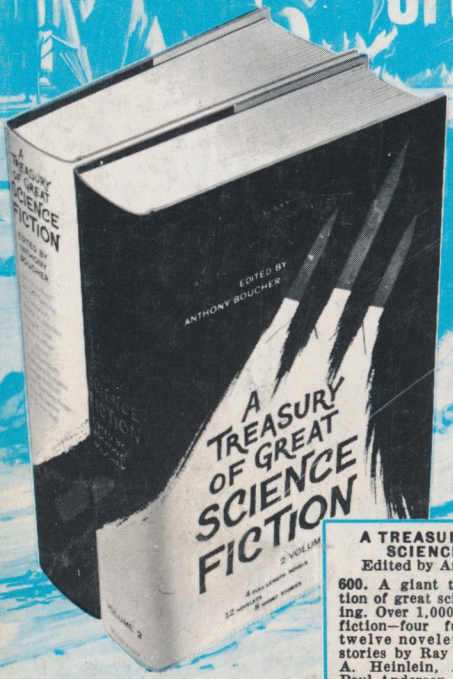

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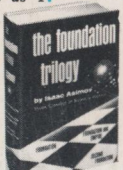

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