ASTOUNDING

A STREET & SMITH PUBLICATION

SCIENCE FICTION

20 CENTS

MAY 1939

COILS OF TIME

by

P. SCHUYLER MILLER

DANDRUFF can be MASTERED

Listerine Antiseptic kills the stubborn germ that causes dandruff

DAY after day they come . . . a steady stream of letters, from every part of the country . . . unsolicited corroboration of a *fact* demonstrated in laboratory and clinic—dandruff *can* be mastered with Listerine Antiseptic!

Sensational new disclosures definitely prove that dandruff is really a *germ disease!* . . . caused by the stubborn bacillus Pityrosporum ovale!

A wealth of scientific data now clearly points to *germicidal* treatment of dandruff. And clinics have proved that Listerine Antiseptic, famous for more than 25 years as a germicidal mouth wash and gargle, *does* master dandruff . . . *does* kill the dandruff germ!

In one clinic, 76% of the patients who used Listerine Antiseptic twice a day showed either complete disappearance of, or marked improvement in, the symptoms of dandruff within a month.

Now comes this overwhelming corroboration in countless enthusiastic letters. Read these few typical examples, and start your own delightful Listerine Antiseptic treatments today. Even after dandruff has disappeared it is a wise policy to take an occasional treatment to guard against reinfection.

Lambert Pharmacal Co., *St. Louis, Mo.*

"Last year my husband had a bad case of dandruff. Nothing he tried seemed to do any good for it. Finally I persuaded him to try Listerine Antiseptic. At the end of three weeks his dandruff had completely disappeared. Now we all take a Listerine Antiseptic treatment once or twice a month 'just in case,' and we haven't had even a suggestion of dandruff since."

MRS. ERWIN CARLSTEDT
Box 507, Boynton, Fla.

"After the first treatment my hair stopped falling out, and dandruff was practically gone. Since that time I have used nothing except Listerine Antiseptic on my scalp."

MRS. PAUL NESBITT
Chama, New Mexico

"Since using Listerine as a preventive for dandruff, I really feel safe as to my appearance in public."

HENRY W. SCHLETER
Oshkosh, Wis.

"After the first application the intense itching stopped."

MR. JOHN KEESER
Walden, N. Y.

"The most effective treatment for dandruff I ever tried."

MRS. S. C. SLOAN
West Palm Beach, Florida

THE TREATMENT

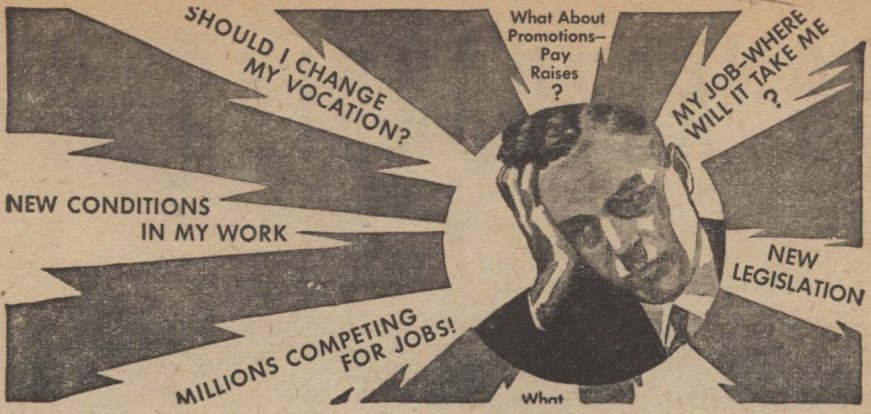
MEN: Douse Listerine Antiseptic on the scalp *at least once a day.*
WOMEN: Part the hair at various places, and apply Listerine Antiseptic right along the part with a medicine dropper, to avoid wetting the hair excessively.

Always follow with vigorous and persistent massage. But don't expect overnight results, because germ conditions cannot be cleared up that fast.

Genuine Listerine Antiseptic is guaranteed not to bleach the hair or affect texture.

Accepted — Good Housekeeping Bureau

LISTERINE ANTISEPTIC
the proved treatment for DANDRUFF



WHERE DO YOU GO FROM HERE?

YOU'RE like a million other men—you're facing a *big* question. The depression turned business topsy-turvy and now the rebuilding period stares you in the face.

Are the things that are happening today going to help or hinder you—what will they mean in your pay check? Where will they put you five, ten, twenty years from now? How can you take full advantage of this period of opportunity?

We believe you will find the answer here—a suggestion the soundness of which can be proven to you as it has been to thousands of other men.

The whole trend today—legislation, spirit, action—is to put men back to work, raise earning and spending power, *give every man a fair chance to work out his own salvation.*

The road to success remains unchanged but, bear this in mind, *what it takes to win is radically different!*

No employer today would dare risk an important post in the hands of a man who had not learned the lesson of '29. Why should he, when right at this moment he can pick and choose and get almost any man he wants at his own price?

Business organizations are rebuilding—reorganizing for the new conditions. Before it is over every man and every method will be judged in the cold light of reason and experience—then dropped, remade or retained. This spells real opportunity for the man who can meet the test—but heaven help the man who still tries to meet today's problems from yesterday's standpoint! Out of the multitude still jobless there are sure to be many frantically eager to prove him wrong and take his place.

Some Men Have Found the Answer

Seeing these danger signs, many aggressive men and women are quietly training at home—are wisely building themselves for more efficient service to their employers.

You naturally ask, "Has your training helped men withstand conditions of the last few years?"

Our answer is to point to a file of letters from many of our students reporting *pay raises and promotions while business was at its lowest ebb*—together with a myriad of others telling of greater success during these recent months of recovery.

Unusual evidence is ready for your investigation. We have assembled much of it in a booklet that is yours for the asking, along with a new and vitally interesting pamphlet on your business field.

This is a serious study of the possibilities and opportunities in that field. It is certain to contain an answer to vital questions bothering you today about your own work and earning power.

Send for these booklets—coupon brings them free. Be sure to check the LaSalle training that interests you most. We will tell you also how you can meet and take fullest advantage of today's situation. No cost or obligation—so why not mail the coupon now?

LASALLE EXTENSION UNIVERSITY
A Correspondence Institution Dept. 465-R, Chicago

Please send me—without cost or obligation—full information about how I can, through your training, equip myself for the new problems and opportunities in the business field I have checked.

- ☐ Higher Accountancy
- ☐ Law: Degree of LL.B.
- ☐ Commercial Law
- ☐ Industrial Management
- ☐ Stenotypy
- ☐ Modern Foremanship
- ☐ Business Management
- ☐ Traffic Management
- ☐ Business Correspondence
- ☐ Business English
- ☐ Salesmanship

Name ..... Age.....

Position.....

Address .....

AST—1

LaSalle Extension University
A CORRESPONDENCE INSTITUTION

STREET & SMITH'S

ASTOUNDING

SCIENCE-FICTION

TITLE REGISTERED U. S. PATENT OFFICE

CONTENTS MAY, 1939

VOL. XXIII NO. 3

COVER BY GRAVES GLADNEY

FEATURE SERIAL

NOVELETTES

SHORT STORIES

ARTICLE

READERS' DEPARTMENTS

Illustrations by Carlson, de Camp, Fisk, Gilmore, Ley, Orban and Wesso.

ON SALE FOURTH FRIDAY OF EACH MONTH. YEARLY SUBSCRIPTION $2.00, SINGLE COPIES 20c.

Monthly publication issued by Street & Smith Publications, Incorporated, 79-89 Seventh Avenue, New York, N. Y. Allen L. Grammer, President; Henry W. Ralston, Vice President and Treasurer. Copyright, 1939, by Street & Smith Publications, Inc., New York. Copyright, 1939, by Street & Smith Publications, Inc., Great Britain. Reentered as Second-class Matter, February 7, 1938, at the Post Office at New York, N. Y., under Act of Congress of March 3, 1879. Subscriptions to Canada, Cuba, Dom. Republic, Haiti, Spain, Central and South American Countries except The Guianas and British Honduras, $2.25 per year. To all other Foreign Countries, including The Guianas and British Honduras, $2.75 per year.

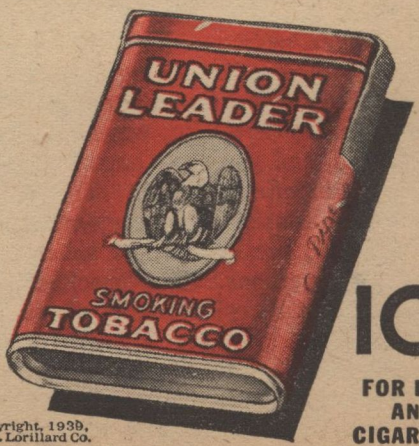
STREET & SMITH PUBLICATIONS, INC., 79 7th AVE., NEW YORK, N. Y.

"A mighty good sign, Son ...your liking Union Leader!"

IT'S A TRIBUTE to any young man's judgment, when he selects Union Leader as his steady brand of tobacco. For Union Leader has been giving men the biggest tobacco value a dime can buy, for more than 30 years.

The rich hill-grown Kentucky Burley that goes into Union Leader is specially aged to add greater mellowness, specially processed to increase mildness and freedom from bite.

Yes, sir! When a young man chooses Union Leader for either pipe or cigarette, he's wise beyond his years! And, in the years to come, this kindly flavorful tobacco will repay his choice by making his bad times good and his good times better!



Union Leader

THE GREAT AMERICAN SMOKE

10¢

FOR PIPE AND CIGARETTE

THOSE MARVELOUS INVENTIONS

AS any "great" inventor can tell you, thousands of wonderful inventions have been made, and are stored on the shelves of grasping companies who buy them up to protect their own more expensive and poorer product. There are hundreds of such inventions—carburetors that would give an automobile one hundred miles to the gallon; little solid pellets that, dropped into a tank of water, turn it into gasoline—hundreds of such things.

I had a car once with a carburetor that gave me forty miles to the gallon, quite consistently. The reason it did that was, of course, that it metered air and gasoline with immense precision. So marvelously precise was it, in fact, that it had to be readjusted each time the barometric pressure changed, and the same setting wouldn't work during the morning and at noon, in the heat of day, and at night when the air was cooler and denser. Further, it required adjustment if the car climbed up a few hundred feet.

But it did give forty miles to the gallon—when the car ran.

I've seen those pellets that, dropped into water, make gasoline. Yes, it definitely is possible—though the well-grounded chemist immediately says "impossible." Certainly, water's already oxidized, and you can't burn something that is, in effect, an ash. The pellets, however, consist of a heavy-metal carbide which breaks down to metal oxide and hydrocarbons. The "gasoline" produced consists of a mess of various hydrocarbons, and forms corrosive gum in the cylinders, tends to carry particles of the metal oxide that score the piston and cylinder walls, and ruin the bearings, but you can make a sort of gasoline from water and pills. It's just a modified calcium-carbide-*cum*-water-makes-acetylene reaction.

It is peculiar that everyone, hearing of the pills-plus-water gasoline substitute, immediately assumes it is suppressed to protect "the oil interests." Water, obviously, would make a cheap fuel. Unfortunately, water isn't the fuel in this case; the heavy-metal carbide, not the water, contains the chemical energy, and heavy-metal carbides are not cheap.

There is, incidentally, another report of a marvelous invention in the Science Discussions department this month. I'm leaving it for the balloon prickers among the readers.

The large number of these inventions reported shelved actually exist, many of them do as is claimed, though many are in the class of the device mentioned in the letter above referred to. But the reason for the shelving of the scientifically possible gadgets is not that given—to protect some established interest. A thing may well be scientifically sound, and still be eminently impractical as an economic item. People simply aren't so interested in economy of gasoline that they'll readjust the carburetor every few minutes—even in Italy, where, certainly, there is a governmentally deplored lack of "oil interests" to be protected.

And the fact that water enters into a composition does not make the final product costless. Perhaps we should substitute cake for bread, inasmuch as considerable water is used in making a cake?

THE EDITOR.

HE THOUGHT HE WAS LICKED-THEN A TIP GOT BILL A GOOD JOB!

I'LL TRAIN YOU AT HOME *In Your Spare Time For A* GOOD RADIO JOB

J. E. SMITH, President National Radio Institute Established 25 years.

He has directed the training of more men for Radio than anyone else.

Many Radio Experts Make $30, $50, $75 a Week

Radio broadcasting stations employ engineers, operators, station managers and pay well for trained men. Fixing Radio sets in spare time pays many $200 to $500 a year—full time jobs with Radio jobbers, manufacturers and dealers as much as $30, $50, $75 a week. Many Radio Experts open full or part time Radio sales and repair businesses. Radio manufacturers and jobbers employ testers, inspectors, foremen, engineers, servicemen, in good-pay jobs with opportunities for advancement. Automobile, police, aviation, commercial Radio, loudspeaker systems are newer fields offering good opportunities now and for the future. Television promises to open many good jobs soon. Men I trained have good jobs in these branches of Radio. Read how they got their jobs. Mail coupon.

Many Make $5, $10, $15 a Week Extra in Spare Time While Learning

The day you enroll I start sending Extra Money Job Sheets; show you how to do Radio repair jobs. Throughout your training I send plans and directions that made good spare time money—$200 to $500—for hundreds, while learning. I send you special Radio equipment to conduct experiments and build circuits. This 50-50 method of training makes learning at home interesting, fascinating, practical. I ALSO GIVE YOU A MODERN, PROFESSIONAL ALL-WAVE, ALL-PURPOSE RADIO SET SERVICING INSTRUMENT to help you make good money fixing Radios while learning and equip you for full time jobs after graduation.

Find Out What Radio Offers You

Act Today. Mail the coupon now for "Rich Rewards in Radio." It's free to any fellow over 16 years old. It points out Radio's spare time and full time opportunities and those coming in Television; tells about my training in Radio and Television; shows you letters from men I trained, telling what they are doing and earning. Find out what Radio offers YOU! MAIL COUPON in an envelope, or paste on a postcard—NOW!

J. E. SMITH, President, Dept. 9DD
National Radio Institute, Washington, D. C.

THIS FREE BOOK HAS HELPED HUNDREDS OF MEN MAKE MORE MONEY

HERE'S PROOF THAT MY TRAINING PAYS

Broadcast Operator After Twenty Lessons

"When I had completed the first twenty lessons I had obtained my license as Radio Broadcast Operator and immediately joined the staff of WMPC, where I am now chief operator."—HOLLIS F. HAYES, 85 Madison St., Lapeer, Mich.

$10 to $25 a Week in Spare Time

"I am making from $10 to $25 a week in spare time while still holding my regular job as a machinist. I owe my success to N. R. I."—WM. F. RUPP, 203 W. Front St., West Conshohocken, Pa.

$3,500 a Year in Own Business

"After completing the N. R. I. Course I became Radio Editor of the Buffalo Courier. Later I started a Radio Service business of my own, and have averaged over $3,500 a year."—T. J. TELAAK, 657 Broadway, Buffalo, N. Y.

J. E. SMITH, President, Dept. 9DD
National Radio Institute, Washington, D. C.

Dear Mr. Smith: Without obligating me, send "Rich Rewards in Radio." which points out the opportunities in Radio and explains your 50-50 method of training men at home to become Radio Experts. (Please Write Plainly.)

NAME.....AGE.....

ADDRESS.....

CITY.....STATE.....

Mr. Mattingly & Mr. Moore discover a truth about fine whiskey!

THERE'S a blue ribbon entry in fine whiskey values...and its name is Mattingly & Moore!

You see, M & M is ALL whiskey ...every drop *slow*-distilled. What's more—M & M is *a blend of straight whiskies*—the kind of whiskey we think you'll agree is *tops!*

Get M & M at your favorite bar or package store—*today!* Start treating yourself to a grand, mellow whiskey—at a grand, low price!

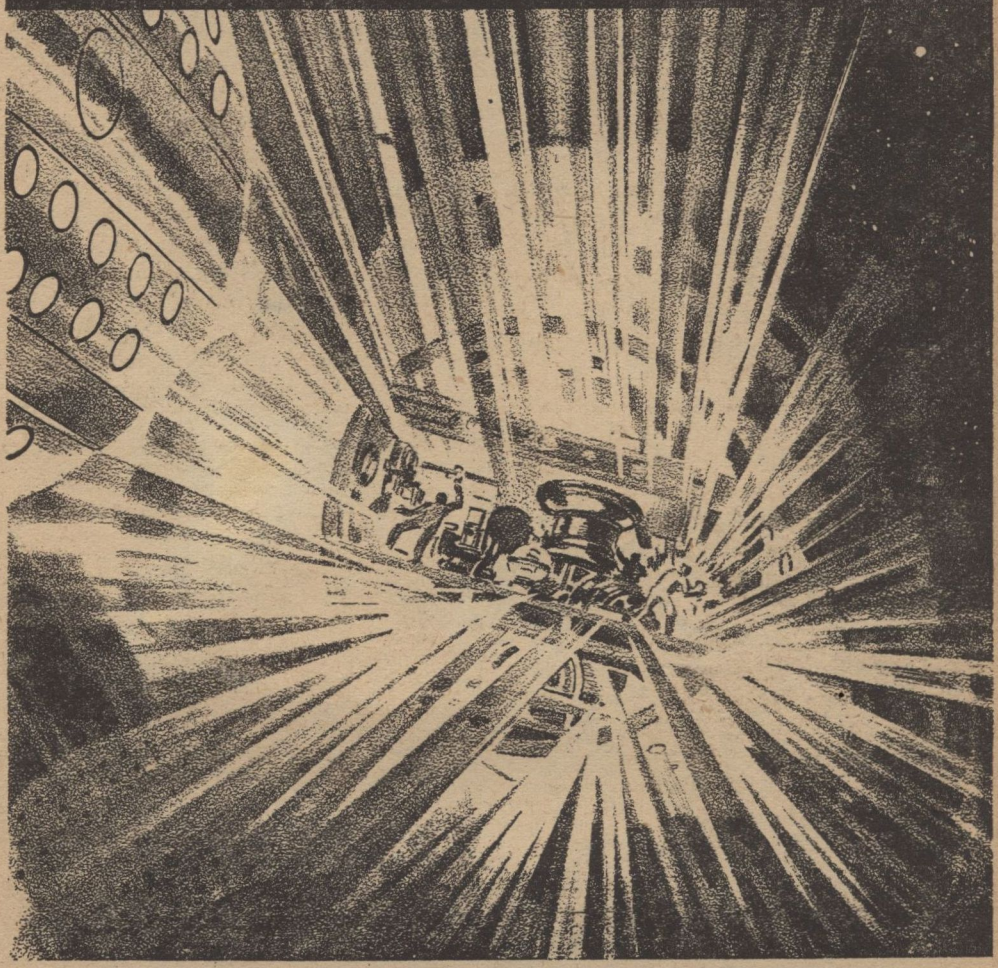
Mattingly & Moore

Long on Quality—Short on Price!

A blend of straight whiskies—90 proof—every drop is whiskey.
Frankfort Distilleries, Incorporated, Louisville and Baltimore.

This advertisement is not intended to offer alcoholic beverages for sale or delivery in any state or community where the advertising, sale or use thereof is unlawful.

COILS OF TIME



By P. SCHUYLER MILLER

THE captain of the tramp freighter *Spadron* plunged into the very private office of the Space Patrol's Brass Hat, jittering in his whiskers. His crew of three Venerians had locked themselves in the cargo hold and were drinking themselves blind. Hell had rolled over and yawned at them.

When the man's chin no longer trembled, some of his words became intelligible. They had seen a Thing. It was

as big as the Moon—bigger—with a huge, gaping mouth and a little round body. A single glittering eye glared malevolently from the rim of its mighty gullet. Its skin glistened like cold steel. And as they stared in horror, it gulped a meteor as big as the Polar Pyramid and plowed away unconcernedly through space.

That was when the crew made for the hold. They had slammed the hatch in his very face.

Back in one of the less occupied corners of his mind, the Brass Hat had been expecting something like this. The Pasturas had just issued a new catalogue.

Pastura Brothers was an institution in the twenty-second century. Back when space flight had begun to get in a rut, and there was talk of a World President and an Interplanetary Council, their grandfather had decided to attempt what one Henry Ford had done generations before—on a vastly bigger scale. The *Spadron* was a Pastura ship. So was the orbital sphere which housed Patrol Headquarters and chased the Moon around the Earth at a safely remote distance. So was the lean new yacht of the Martian delegate to the Council, now in special session in one of the many insulated rooms in the Polar Pyramid. And so was SD-1.

The new catalogue had been off the presses just about a week, and SD-1 was an experimental model appearing for the first time. As was their custom, Pastura Brothers had turned over their first ship to the Council, which promptly placed it in the custody of the Space Patrol for special testing.

The Brass Hat permitted his thin lips to curve ever so slightly. He buzzed brusquely for an orderly.

"Here," he ordered, "take Captain Sprewl somewhere and show him SD-1. Then bring me that *Lustris* report."

SPACE DREDGE ONE, familiarly known to its somewhat overimaginative pilot as the *Ourobouros,* was plowing her massive way through sixth sub-Tellurian sector, a few degrees above the ecliptic. In the thick quartz dome which housed her controls, Rutherford Bohr Adams snored blissfully, both trim boots elevated on the chart table.

Brrrrram! A gong went off like the crack of doom. One jump lifted him out of his chair. Meteors ahead!

He spun his viewing dials. Space rolled across the vision-screens as bank after bank of photo elements came into the circuit. He caught the winking glint of metal. There they were!

They were off his course by a good thousand miles. According to orders he was sweeping space on a hidebound, precharted schedule with no more give in it than a pair of dress pants. But those Council scientists had a nasty way of looking at you when you brought back a load of dust and general space drift without any of the big stuff. In four short test trips with the *Ourobouros* he'd made himself something of a reputation. They called him "comet chaser" in the Patrol. And from the look of the dials, Lot 4 could stand fattening.

Bracing both feet he yanked over the firing lever. With a lurch the dredge picked up speed. Her mile-wide funnel mouth gaping enormously, she sidled through the void toward the approaching meteor swarm. Adams watched his charts tensely. Armor or no armor, a meteor in the wrong place could be nasty!

On the screens the swarm was a white blur, drifting slowly toward the cross hairs as the ship came about. In a few seconds it showed distinctly as a cluster of milling bodies, with a diffuse halo of finer debris. There was a flicker of steely light dead ahead, a crash that rocked the entire ship, and space was empty again.

It was flexalloy that made the *Ourobouros* possible. The space dredge was a mile-wide funnel of heavy armor plate, tapering to a half-mile gullet. Behind was a bulb of the strongest, toughest steel available on three planets, lined with successive skins of flexalloy. These were, literally, the bags which Adams was supposed to fill with the sweepings of "empty" space.

He wondered what he'd bagged. It usually paid to look over the big stuff. Sometimes there were things that rated a "Special" in the log. Deftly he fingered the keys that controlled the magnetic handlers. Automatically the flexalloy pouch closed and was drawn aside. A section of the inner armor slipped back. Two minutes from the time the gong sounded, Lot 4 was stowed away in a numbered compartment in the ship's skin.

Adams wriggled into his space kit. His mind wasn't on meteors. Before he dozed off, he'd been reading "Murder of a Plutonian," the new Billingsley Shropford yarn. Eagerly he had watched the great detective track down the unknown slayer of the Plutonian plutocrat. Then came the familiar challenge:

"THINK!"

For all of five minutes he had sat staring blankly at the big red letters. That was all he remembered, until the gong went off. Dammit, he *always* fell asleep when he tried to think!

Adams climbed wearily down the ladder to the collection chamber. He halted at last where a lateral passage ran around the neck of the great bulb, and stared through a port into its black interior. You could hide the navy in there! SD-1 was the biggest man-made thing in space.

Lot 4 had stopped hammering around in a frenzy of waste motion and was piled against the back of the stowage chamber. Adams climbed through the airlock and spread open the folded pouch. He grunted in disgust. Trash! On sectors nearer Earth he had hauled three and four times as much in every five-hour sweep. Then a familiar shape caught his eye.

A message rocket!

It was hammered flat by the milling masses of metal whose gravity had captured it. Its chrome armor was gouged and pitted, and its oxide enamel splintered. He dragged it out and stood it on end. One stabilizer vane was miraculously intact, and the deep-blue letters stood out boldly:

"LUSTRIS"

MORE THAN ten years before the *Lustris*, with fifty passengers and a large crew, left Mars for Venus. Earth was across the Sun at the time. And ten days out of Laxa the *Lustris* vanished.

She was the first. She was one of the smallest. In ten years, twenty liners and an uncounted number of smaller fry had been swallowed up by the void. More than ten thousand lives had been snuffed out. And there was absolutely nothing to show how, or why.

Rutherford Bohr Adams burned inwardly with an unholy fire. His orders said nothing about sampling specimens, but his curiosity was saying plenty. Before his wide blue eyes flashed a vision of Billingsley Shropford, marooned on a runaway comet with the sole clue to the killer of Daja Thok, the beautiful Martian courtesan. Time meant life or death! With a moan of ecstasy he scrambled up the long ladder and dived into his quartz-domed cabin.

He didn't bother to shed his suit. He flung back the helmet, shrugged his arms out of the sleeves, and reached for a prizing bar. Vehemently he jimmied the little rocket into a semblance of its proper shape. Eagerly he pried off its lid and shook out a roll of fine wire. With trembling fingers he crammed the

battered spool into the magazine of his vocaphone.

Words came! Stray fields had partially demagnetized the ribbon, but there were words—weak, tinny, scratchy—but *words!*

"Barstow, liner *Lustris.* Co-ordinates 6E-3-256 . . . proper motion which will bring it into our course in about thirty minutes. Visually it is a tenuous golden glow. Professor Case has requested . . . may be some rare sub-atomic phenomenon. This does not explain its extraordinary golden glow, nor the strong effect on the space charts. It seems . . . report will follow when we have completed our investigation."

Adams stood staring at the whipping, clicking end of the wire. What did it mean? What had happened? Why had that second report never reached Earth?

He sat down slowly. His agile mind was working rapidly. He was seeing pictures—visioning a weird, squat spaceship hovering in the void, two glittering electrodes jutting from its poles. A golden haze began to grow around them—to spread—to swell into a great, glowing golden globe that gathered about the ship, hiding it from view.

He saw the *Lustris,* moving slowly to intercept the golden mist. Men were crawling out of her airlock, clinging like flies to her steel hull. Other men were handing up instruments to them. And the *Lustris* was slowing—swerving—drifting into the Golden Glow!

He saw armored forms stirring in the pirate ship. He saw great grapples unfolding, reaching out through the yellow mist. Then the outlaws struck! The bewildered scientists went down like mown hay. Before the airlock could be sealed, the bandits were pouring into the doomed ship, ripping it open to the void.

Adams' wide blue eyes were hard. That *must* be the answer. Camouflaged corsairs of space, striking from behind a golden cloud, gutting their prey and sending it hurtling, helpless, into the Sun. Somewhere in this very sector that fiendishly clever outlaw was lurking, shielded by some diabolical invention of his warped brain. Billingsley Shropford had more than once met—and vanquished—such fiends in human form. And this time he, Rutherford Bohr Adams, was the only man in all space who knew the truth!

A SUDDEN thought struck him. The *Trixton* should be sighting him any time now. She was one of the new supergiants of Interplanetary Lines, bigger than the orbital sphere that housed Patrol Headquarters and very little smaller than the *Ourobouros.* Passengers and crew together, there would be over a thousand men and women aboard. What a prize she would be!

He switched on his transmitter and began to jockey the key. The space chart dimmed almost to blankness as he cut in its double bank of tubes. If he was going to raise the *Trixton* this near the Sun, he'd need all the power he could get.

"Trixton. Trixton. SD-1 calling *Trixton.* Danger. Danger. SD-1 calling *Trixton.* Beware of pirates—"

Before him the space chart blazed with light. A disk of white burned there, rimmed with pale fire. It grew fiercely brighter. Adams flung his arm across his eyes and reached blindly for the firing lever. With a lurch the great dredge swung in a drunken quarter circle. Pouring down through the crystal dome was a flood of ghastly yellow light.

The Golden Glow!

With a burst of flame the tubes blew out and the chart went dead.

Adams stared spellbound into the heart of the Glow. It was a disk of shimmering yellow, edged with soft fires, spread like a veil across the Sun. It was near—very near—but the *Ouro-*

bouros was moving obliquely away from it.

A plan leaped into his whirling brain. He'd been right: the *Trixton* was too great a prize to miss. She'd have guards aboard, but they'd never heard of the Golden Glow. Nobody had—except himself and the poor devils who'd been caught. Only the *Trixton* wouldn't be alone!

Grinning boyishly, Adams brought the big dredge about. Steadily he edged over the firing lever until the acceleration began to push the pattern of his chair seat into his breeches. The Glow was spreading—becoming a vast yellow curtain that blotted out the heavens. With grim accuracy he aimed the funnel mouth of the sweeper at its geometrical center. He reached over and pecked with one finger at the keyboard of the recorder. It whirred and spat out a punched metal tape. "Special Lot 5." He'd hang that tag on the neck of the murderer of ten thousand helpless men and women!

Every jet belching hot atomic fire, the *Ourobouros* plunged into the Golden Glow. Adams felt a queer plucking strain growing in his mind and body. It was inside him. He wanted suddenly to scream and strike out with his fists. He wanted to burst into tears, and hack and slay. He kicked himself free of his suit and strode belligerently across the floor. He flung down the huge switch with the red handle that was set in the middle of the power board. Emergency power! Well, this was his idea of an emergency. He'd show 'em all! He'd—

Space turned inside out.

Every nerve in his body shrieked with pain. His brain was an eddy of light and cachinating sound, spinning in that sea of little pains. Faster and faster it spun, swelling until it filled the world—until it was bigger than the world—until it was heaven and hell and God and everything that was! Then there was nothing. There was a black emptiness into which he was falling interminably. Out of the blackness a crimson bomb rose and burst soundlessly before his eyes.

The universe righted with a jerk.

The Glow was gone!

Adams got slowly to his feet. A dozen dials were swooping toward the red danger line with all the energy of the emergency power-burst behind them. Automatically he checked their mad climb. Those rats had plenty! Whatever it was they'd used on him, it was brand-new and devilishly potent! But he had 'em—where they'd keep!

It would take him a good hour to fix the screen, even if the connectors weren't fused clear back to the power chamber. Well—eyes were made before screens. With one hand on the lever, he rolled the ship slowly, eyes fixed on the starry vault above. The *Trixton* should be close enough to show a visible disk.

Into the inky sea swam a red, dwarfed sun. Its face was mottled with swarming spots. Faint flames licked feebly along its shrunken edge. And behind it, all around it, the stars were—wrong!

A silly grin froze like a Greek mask on Adams' face. He stared round-eyed at stars that didn't exist and a Sun that couldn't be. His knees bent under him, and he sat down hard. But even as he hit the chair his fingers were groping for the control keys and his right hand was easing forward the firing lever. If something dirty was brewing, he wanted momentum and plenty of it!

Eyes on his dials, he pushed the lever ahead. Nothing happened. The board was dead!

The blank look went out of his blue eyes. His spine stiffened and his mouth snapped shut. This was something he could handle.

Ten minutes later he'd changed his mind about that. Something had milked

the great dredge dry of energy. Something had tied up every instrument on his panel as effectively as if they'd been filled with glue. And if his own increasing weight meant anything, the *Ourobouros* was being towed through space like a tin minnow on a trolling line!

FOR BETTER than two hundred years, action had been the meat and drink of mystery fans the System over, and Adams was of the inner circle. As life grew easier and chairs softer, the world's great fictional detectives left their secluded laboratories and went out to do violent personal battle with the forces of evil. Billingsley Shropford was like that, "THINK" or no "THINK," and Shropford always got his man!

Adams jammed a gamma gun into his belt and slipped another into the outside holster of his spacesuit. He disconnected the suit's oxygen flask and replaced it with a full one. It was awkward to have your air give out just when things started moving. Clamping his helmet down tight, he turned instinctively to check his dials. The dredge was still spinning with the torque he'd given it before the board blew out. The dwarf sun was gone, but in its place swam a colossal metal city of the void.

Men had made that metal world and hung it in an orbit above the shrunken sun. Men had shaped its doughnut ring of shining steel, studded with glittering quartz eyes, and set it turning slowly on a shaft of yellow fire—on the Golden Glow. How big it was he couldn't guess, with nothing for comparison, but he'd seen the Moon look smaller. Suddenly it snapped into perspective. A sliver of polished black was slipping out past its golden core, a long black ship, slip-lined for speed and battle, headed for the *Ourobouros* and for him!

Schemes scampered like waltzing mice through Adams' head. With the dredge crippled he couldn't fight. He knew the ship as a spider knows its web, but there wasn't a corner where a good detector wouldn't show him up. He had minutes and mighty few of them. Anyone who could paralyze a ship the size of the *Ourobouros* and haul it crabwise across space wouldn't be stopped by anything as simple as a Pastura airlock. He glanced hurriedly around the cabin and his face lit up. He had it!

It was an old gag, used a hundred times by every hack writer on three worlds, but they might not have books in this cockeyed neck of nowhere. Three spare suits hung on the cabin wall. Ordinarily the *Ourobouros* would carry a two-man crew, with a pair of suits for regular use and two spares. There were two bunks, two lockers—two of everything. A stranger couldn't tell whether it housed one man or two—and thereby hung the gag.

The emergency airlock opened out of the dome room. He lifted down two of the empty suits, gave their intake valves a twist to inflate them, and popped them into the lock chamber. As he crouched beside them in the darkness, screwing up the outer hatch, a grating jar ran through the ship. The pirates had made contact.

Cold sweat beaded his upper lip. The sands of time were running mighty fast. He raised the hatch gingerly and peered out. The other ship was hidden by the bulge of the hull. One after the other he boosted the suits into space and watched them drift away. Leaving the lock open, he scrambled back into the cabin. Let 'em think there had been two men who'd bolted into space, if they wanted to.

Backing against the wall, Adams reached up and gripped the hooks on either side of him with his mittened hands. With a kick and a wrench he was up, he felt his air pack slam against the wall, and then he was dangling like a butchered pig from the eye-ring in the middle of his back. Quickly he pulled

his arms out of the bulky sleeves and ducked turtlelike through the neck hole of his helmet. Now—he hoped—it looked as though the crew had run out and left two empty suits hanging on the cabin wall. His fingers found the gun he had slipped into his belt. The first man to investigate those two suits would be sorry!

IN SPACE, where there is no air to carry sound, a man grows sensitive to other vibrations. Adams knew, by the infinitesimal jarring that was transmitted from the ship's hull through the hook and eye-ring to his suit, that three men were tramping up the corridor from the main lock, and that they were coming slowly, looking for trouble.

They filed cautiously into the cabin, one after the other. The gun itched in his fingers. With half a break he could get them all through the suit—but what then? No—the fox's game was to sit tight.

He "listened" with every nerve as they moved slowly about the little room, poking into the lockers, studying the controls. He felt the emergency hatch slam shut and guessed they were letting air back in the ship. That meant they would be staying. It meant more than that. Air carried sound—they would hear his muffled breathing, hear the thumping of his heart against his ribs, hear the traitorous hiss of spent air from the exhaust valve of the suit.

Sweat dripped from his rigid chin. Sweat made his palm slippery where it gripped the gun stock. It was stifling in the suit. He could hardly breathe. Maybe the intake valve was jammed! Maybe—

The tip of his nose began to itch. He wriggled it, to no avail. Presently the itch began to travel; it moved with agonizing slowness across his cheek to the lobe of his left ear, then back to the corner of his twitching mouth. He dug at it furiously with his teeth, and, like an imp of perversity, it jumped suddenly to the small of his back and began to grow.

He could hear footsteps padding back and forth across the metal floor. They were in the cabin—within arm's length of him. They could burn him down in a moment—but he had to scratch that itch! Slowly he twisted his free arm behind, stretching for the place that he could not quite touch. Very, very gingerly he arched his back, then hung breathless as he heard the footsteps come tapping across the floor toward him.

His fingers clamped tighter on the gun butt. They knew he was here. The footsteps stopped. In a second their rays would be burning into his vitals. Let 'em come!

Savagely he hurled himself erect. His head jammed back through the neck hole of his helmet. He stared into a man's face.

The face was black, thin-lipped and narrow-eyed. There was surprise in those eyes. A hole appeared between them, a crisped circle blacker than the skin. Adams felt the kick of the gun against his stomach; felt it kick again and saw corn-colored curls sizzle and smoke across the man's scalp as his knees folded and he crumpled to the floor.

Adams hung staring down at the man he had killed. A black man with corn-yellow hair, dressed in tight shorts and a brief tunic of copper mesh under a suit of some flexible, skin-fitting substance as colorless as glass. He felt his own suit sagging and smelled the reek of burned rubbed where his ray had blasted through. There could be no more hiding his presence in the ship. He wriggled free of the hook and dropped lightly to the floor.

There was enough air in the ship so that his suit had stopped leaking, but it behooved him to get better protection at once. Quickly he donned the other suit, then dropped on one knee beside the

body of the black.

The man was not a Negro—his bright-yellow hair proved that, and his features were fine and aquiline. No race that Adams knew would yield a crossbreed of his type. A fat-barreled gun lay beside him. Adams picked it up and fumbled experimentally with the button set in its knurled grip. It jerked in his hand and a whining slug spanged against the quartz dome overhead. No noise but plenty of power! He tucked the thing in his belt, with a clip of little white metal cubes that looked like ammunition.

Rutherford Bohr Adams got thoughtfully to his feet. The answer to this crazy riddle—the mystery of the Golden Glow, and the little red sun, and the black man—was up there in the doughnut city of steel. And that was where he was going.

THEY MIGHT be keeping an eye on the emergency port; after all, he had done his best to call it to their attention. But he still had strings to his bow. Half an hour later, dragging the ungainly ten-foot length of a rocket stick behind him, he emerged from the gaping funnel mouth of the *Ourobouros* and stared gloomily up at the maze of glittering constellations spread before him. Only the diamond-dusted band of the Milky Way looked at all familiar. Home was mighty far away.

Stalling around would get him nowhere. Clamping the crossbar of his space stick in the crook of his right knee, he hooked an arm through the hand grip and picked up the manual control. The first blast from its miniature rockets sent him soaring a dozen miles above the metal city and the gleaming cone of the dredge. The steel torus must be all of twenty miles across. It could house a nation. No ordinary pirate crew would be based in a stronghold like that.

He twisted the stick under him, until its nose pointed at the city's center. There was a shaft there—the hole in the steel doughnut—a good five miles in diameter. Out of that shaft plumed the misty streamers of the Golden Glow. Through it the *Ourobouros* had come, and through it, somehow, he was going back!

His suit would be practically invisible against the black of space. Only the fiery plume of his rockets could betray him, and if he gauged his trajectory properly, they would flare for only an instant. He let his fingers close slowly over the control, then dropped it, gaping.

The Glow was gone. Where it had been a hole bored into space—a blackness eating into blackness. And out of that black shaft into nothingness a silver dart appeared—the *Trixton!*

The black corsairs had dipped their net again!

Hanging there above the city, Adams watched it all. Golden fire puffed suddenly into the black hole, spewing the *Trixton* into space. A shimmering phantasm plucked it back—a rope of emptiness through which the far stars danced and pinwheeled giddily. A puckering of space itself that beckoned the silver minnow with invisble, irresistible fingers. The *Ourobouros* was forgotten, and he with it. They had tastier prey!

The Glow was fading, but this time there was no gaping pit of blackness in its place. He could see tiny glittering dots darting about in the shaft—one-man tugs easing the netted *Trixton* into the city's lock. A massive port swung shut and hid them—all but one gleaming speck that was moving out across the void toward the *Ourobouros,* and the dead man he had left behind him.

Small as he was, a good screen could pick Adams up. Screens were made for that. But, as part of the vast mass of the metal city, they might hunt for him forever. One puff should do it.

Hugging the stick, he watched the rings of glittering portholes drifting up toward him. Were there black faces at those windows—narrow eyes watching the fool who was swimming into their net on his little fire stick?

There were not. Clinging with magnetic grips at the edge of one of the great quartz panes, close to the city's rim, Adams peered into a curving corridor on whose floor the dust of centuries lay soft and thick. Whatever lay up there near the central shaft, this outer section of the city seemed to have been deserted for longer than made any difference.

Adams was never one to let a lack of tools daunt him. He opened the head of the space stick and slipped out one of its charges—a neat, round pellet with plenty of potentialities and a very ticklish disposition. He shook it gently, but nothing happened. The Adams luck was working. Only how in blazes was he going to stick it to the window?

Titles began to flicker through his brain—"Slaughter on Saturn"—"Death Walks on Deimos"—"The Comet Curse." Billingsley Shropford quelling the Venerian revolution. Billingsley Shropford outwitting the priests of Halley's Comet. Billingsley Shropford lost in the frozen helium desert of Pluto.

By whacky—he had it!

BY TYING himself in a knot he brought the exhaust valve of his suit close to the steel rim of the window. There was enough moisture in a sudden blast of warm air to freeze the fuel disk fast to the steel. His fingers twisted the valve and he felt suddenly dizzy as the air gushed out of his helmet. Straightening up, he looked with satisfaction at the gleaming patch of frost. Nice going, Adams!

The next part had to be done at once, before the ice evaporated and his fuel pill skittered off into space. He sidled away along the steel surface of the city until he could just see the tiny smear of white. With a watery feeling in his knees, he raised his gamma gun. Something mighty impressive was going to happen immediately, and whether he'd be around when it was over was something his hunch hadn't told him. He leveled the sights against the white patch, shut both eyes tight, and let fly.

The wonder is that he hit the window at all. The shaft of star-white flame that vomited into space peeled the skin off his face and left him dazed and sightless for a good five minutes. When colored spears stopped stabbing at his retinas, Adams saw that all the accumulated dust of centuries was belching into space through the blasted window, propelled by a geyser of escaping air that an elephant with mudhooks would have had trouble in bucking.

There was no elephant in the Adams family tree. His magnetic shoes would be about as much use in that tempest as a spiderweb towline. And there was no telling when the people in the city would come to find out where their air was going.

Once in a blue moon the obvious penetrated Adams' think tank. This was that once. Straddling his space stick like a warlock late for a Black Mass, he looped sharply around and dove headlong into the middle of the dust storm. For a moment it seemed that the wind would tear him from the stick, then he smashed headfirst into a steel bulkhead and subsided with a grunt upon the ruins of his stick.

When he could sit up, the air had cleared. Rather, there was no air left. Steel doors had dropped out of the ceiling, sealing off the open section. He was inside, but for all the good it did him he might have been back where he'd started.

With a blank stare of bafflement on his handsome features, the disciple of Billingsley Shropford sat down to figure things out. Pretty soon he thought he had it. There had to be some gauge to

trip the gate when the air pressure fell. A little hunting showed it to him—a simple aneroid disk set flush with the wall. With pardonable glee he pressed on its diaphragm and at once the ponderous bulkhead began to rise. The moment it cleared the floor a howling dust storm was swirling around him, and before he could move he felt the crash of another door closing off the section beyond.

This kind of monkey business was getting him nowhere. He could go on forever opening and closing doors. There had to be another answer—and sheepishly he realized that there was a very obvious one. Each section of the city had its own lock, through which workmen could pass to repair leaks. It took him only a moment to find it, and presently he was standing on the other side of the bulkhead. Cold-light globes in the ceiling showed him ramp after ramp, climbing straight for the center of the toroidal city. Branching corridors sectioned off each level into blocks of steel-doored rooms. There was dust everywhere. Then his wandering eyes lit on something that brought him up on his toes.

Scuffling feet had beaten a trail in the dust just ahead. Men had made those tracks, and men knew answers. Without more ado, Adams followed the trampled trail smack into the history of two worlds.

IT ENDED before a huge door over which were characters in an outlandish scribble that struck a responsive note in Adams' memory. Some crackpot archæologist, snooping around in tombs and garbage heaps, had showed him something like them. But where, and when? He gave it up and pushed cautiously on the door. It gave a little. Then just behind him he heard the sound of marching feet.

In a flash he was through the door. A light flashed up, showing him a vast, steel-walled room filled with tier on tier of tilted shelves. And on them, stacked rank on rank like butchered beeves, were human corpses!

Every curl on Adams' round skull prickled. A dribble of cold sweat slid clammily down his spine. And with a crash like the crack of doom, an army halted outside the door.

The room was bare save for its racks of dead. There was no place that a rat could have crawled into, and no place a rat would have chosen if he could. Like a scared deer Adams disappeared among the stacks; then, like that same deer, he came creeping back to see what he could see.

There was a machine opposite the door—a vast, crazy-looking thing full of helical coils and long quartz tubes that might have resulted from a mesalliance between a laboratory and a junk yard. Something whispered in Adams' inner ear that it could tell him more about this fantastic mess he was in than anything he had seen.

The opening of the door warned him that his position was somewhat precarious. Quelling the revolt of his insides, he hooked his fingers over the corpse-laden rack and began to climb. The top shelf was empty, and by lying flat on his stomach he could look down on the weird machine—and on the things that ran it!

They had been men. They were mother-naked, and bone-white, and shrunken, and their corded veins and popping eyeballs blazed with a cold, hard light, like the frozen blue glitter of Sirius. Their skin was dry and scaly, and their heads were as bald as peeled eggs. One after another, they were filing through the open doorway and taking their places at the machine, line after line, like automatons of translucent alabaster lit with a blue inner flame.

Fascinated, he watched them. A line of them was filing through the doorway, stooping, straightening, stalking

away. Adams edged forward, and his fists clenched as he saw what they were stacking, like cordwood, beside the machine. This was the real loot of the plundered *Trixton*—of all the scores of ships that had been sucked into the Golden Glow! Not gold—not wealth—but human bodies!

Men, women and children, the passengers and crew of the *Trixton* were carried in and stacked in windrows beside the great machine. On and on the lines of ghoulish bearers filed, every step just so, every motion precisely timed. Adams saw that little black cubes were clamped at the base of each naked skull where the great spinal nerves entered the brain, with wires digging into the glowing flesh like the legs of a giant spider. In those little cubes, he decided, must lie the power that had raised this zombie crew and set them at their inhuman task.

THREE of the living dead stood ready by the machine, their naked, glowing bodies twitching to the beat of that clacking goosestep. One—two—three—four. Out of the machine slid the rigid body of a man. The waxen pallor of death had left him; he lay as though asleep, his eyes closed, a faint flush on his cheeks, but unbreathing. The first robot seized him, stripped the black-and-silver uniform from his body, and passed him to the second. Adams stared down into his upturned face. It was Eric Helm—Sparks of the *Trixton!*

The deadly rhythm hammered in Adams' brain. One—two—three—four. Helm's stiff body slid into the coil that formed one whole side of the machine. His head came out at the other end, his lips curled back over his white teeth, the muscles of his throat corded in agony. Five! A skeleton hand flung down a switch. Long purple sparks snapped around the coil's insulators. Eric Helm's body came alive, his glazed eyes wide and rolling, his mouth gaping in a shriek of pain.

Six—seven! Glowing claws clamped on Helm's shoulders. A shining needle, connected to a tall glass cylinder, plunged into his throat. Eight—nine! Blue fire surged into his distended veins, blazing through his wrists, his thighs, his hollow temples, burning in his staring eyes. A plunger rose and fell, and the cylinder was filled with a bubbling sapphire brew in which eddies of bright crimson were swirling, dissolving.

Ten! The switch snapped back; the violet glow of the coil faded. Eleven! Twelve! Out on the floor stepped the glowing, naked thing that had been Lieutenant Eric Helm, a little black cube clipped to the base of his numbed brain, cold blue fire running in his veins. Stiffly he strode down the aisle between the tiers of shelves. A dead hand touched the cube and he toppled forward. Dead arms caught him and lifted him to one of the shelves. Another rigid form was laid beside him—another and another—men and women, stiff and unseeing, their naked white bodies burning dimly with the blue radiance, filed row on row in this vast mausoleum—for what purpose?

One—two—three—four. Five—six—seven — eight. Nine — ten — eleven — twelve. The inhuman, mechanical rhythm dinned into Adams' brain. Men he knew—men like Eric Helm who had been his pals in training school and in space—who had lived with him and fought with him—turned into blue zombies, marionettes with neither life nor death, dancing, marching, working the will of some black Dracula in this nightmare world! There was a hard light in his eyes. His hand closed over the butt of his gamma gun, and he was edging forward for a clearer range when the great door opened again.

Flat on his stomach on the shelf Adams studied the group in the doorway. There were six blacks, like the man he had killed, with stubby, fat-muz-

zled guns in their hands. They spread fanwise in front of the door and snapped to stiff attention as another man appeared behind them, flanked by two burly black guards—a white man.

He was taller than Adams, who could look down on six feet. He had a head like an upended pear, and a hawk face that reminded Adams of the Egyptian mummies he had seen in the museums back home. He had hair like fine-spun glass, white and silky, and burning black eyes with the fanatic's glare in them. Adams' fingers itched on his gun hilt. If only he dared to shoot—

The white giant had authority; it stood out all over him. He barked an order and the blacks scattered among the tiers. He spoke again and the automatons froze in their tracks. But Adams was no longer watching. Those black devils were looking for him.

SQUIRMING backward, he put the rack of shelves between him and the door, then dropped cautiously to the floor. The blacks were out of sight, searching methodically among the stacks. A glint of hope lighted his roving eyes as he spied an oval opening in the wall above him—an opening big enough to hide him if he could reach it unseen. Cautiously he raised himself and groped with a gloved hand for the edge of the hole. He found it, and was lifting himself slowly when a scream brought him bolt upright, gun in hand.

At the white giant's command, every blue-veined automaton had frozen in his tracks. A dead hand flung down a switch—and froze. But fierce energies surged unchecked through the slim white body that lay in the machine's glowing coil, a scream of pain and terror shrilled from the girl's lips, and as Adams looked she sprang free of the machine and stood face to face with the hawk-faced master of the robots.

Adams saw the giant's burning eyes take on a hotter fire as they appraised her bare white body, her tumble of russet hair, the beauty of her clear-cut features. His own heart rose bounding in his throat. He knew her!

For a pulse-beat they faced each other, the white-haired giant and the slender girl. Then she was racing for the shelter of the stacks, straight for the narrow aisle where Adams crouched!

He heard the giant shout. He shouted back. Twin stabs of blue-white fire burst from his gun and the two black guards went down. The empty gun clattered on the floor as he leaped at the tier beside him. Hooking his right arm through an upright, he swung down and caught the running girl neatly around the waist. A heave and she was beside him. Her eyes, black with terror, stared into his. Then he had pushed her headfirst into the hole in the wall and scrambled after her.

A narrow tunnel ran straight before him. His helmet light showed the girl, curled up in a tight, scared ball, just as she lashed out with both bare feet. Both heels whacked hard on the front of his helmet, and his nose banged against the heavy quartz, bringing tears to his eyes. The force of her kick sent her skittering on her back along the tunnel; then she rolled over and scrambled away on hands and knees as fast as she could go. His bulky spacesuit all but choking the narrow tube, Adams wriggled after her, expecting every minute to feel the impact of a bullet in his back.

The tunnel turned suddenly at right angles. As he reached the bend something spanged on the steel ahead. He heard the girl cry out, flung himself forward, and sprawled on his face in a cross-tunnel, larger than the first, at whose end loomed a grinning black face.

The girl was crouched against the wall. As the black's gun leveled, Adams' fingers closed on the weapon he had taken from the dead man. A miss was impossible at that range. The grinning face went red and disappeared, and a

screaming slug bounced off the tunnel roof and ripped through his suit, letting out the air in a long, dwindling hiss.

Adams swore. Without his suit he was at the mercy of anyone smart enough to open a cylinder of poison gas, or pump the air out of the ventilation ducts. He gathered his legs under him and looked back over his shoulder, just as another head rose against the disk of light from the room he had left. He blazed away at it, then reached ahead, grabbed one slender ankle, and snaked the girl, yelling and wriggling, to him.

Fear and fury twisted her face into a cat's mask of sheer terror. Her eyes were black pits of hate, her lips a smear of red against her ashen face. She hammered with clenched fists on his helmet and kicked with all the power in her shapely legs, then like a pricked balloon she collapsed in a dead faint.

Adams grinned paternally. Poor kid! Anything human or nonhuman was an enemy after what she'd been through. There'd be plenty of time later for introductions.

HE SENT a beam of light down the tunnel behind them. It ended a dozen feet beyond in a vertical shaft, with a ladder running upward. That, he decided, was where they were going.

The ripped suit was no protection. He unlocked his helmet, took it off, and wriggled out of the sagging fabric. Bundled up, it might make a temporary barricade against snipers. He had an extra gamma gun now—the one in his inside holster—but he had taken a fancy to this stubby, silent, death-vomiting gadget he had stolen. There was something very satisfying in the smack of a high-velocity slug against someone you didn't like.

The rest of the paraphernalia from the discarded suit he distributed about his person. Then, strapping the helmet lamp to his forehead like a miner's torch, he turned his attention to the girl.

He knew her. Somewhere—sometime—he had met her or had her pointed out to him. A man didn't forget hair like hers, rich, warm brown with a flush of red through it. A man would be apt to dream dreams about her red mouth, and the way her nose turned up, and the tilt of her head. A man could get a hefty jag out of a glint of promise in her gray eyes.

He found her pulse; it was beating steadily, and he could feel the rise and fall of her heart where she lay against him. He gathered her up and began to edge back toward the ladder. With the city spinning on its axis, "down" was toward its rim, where he had broken in, and "up" was toward the center of things. Without suits for both of them there could be no escape the way he had come. Ahead—up—meant carrying the war into the enemy's camp, and that was what he'd had every intention of doing, up to ten minutes ago. Only now he had the girl—

She stirred in his arms, then stiffened as she realized where she was. He released her and turned the light of his lamp on his own grinning countenace.

"I won't bite," he told her. "I'm in the same boat you are. Rutherford Bohr Adams, late of the good ship *Ourobouros,* and teetotally at your service."

Color flushed into her face, and she snatched the lamp from his hand and turned it off. He chuckled at the thought of her hugging her nakedness there six inches from him, then sobered. This steel must be damned cold!

"Look," he blurted. "I . . . I'd better give you something to put on. You don't want to catch cold or anything. Then we've got to scram out of here."

He unbuttoned his coat with its silver-and-black insignia, and wriggled out of his trim breeches. Half a loaf was no good to a dame, and luckily heavy underwear was part of the regulation outfit of the Space Patrol. He shivered as the chill of the steel floor struck

through to his skin. He'd be lucky if he didn't get chilblains. His boots would be no good to the girl unless she had feet like a duck, but she might be able to wear his socks. He pushed the bundle of clothing into her arms.

"Get into these," he said, "and then follow me. I'll be waiting for you up above."

Fifteen feet above he came to another cross-tunnel. There wasn't a glimmer of light in any direction. If there were vents like the one they had come through, the rooms beyond must be dark. That might mean that they were empty, or it might mean someone was sitting like a cat at a mousehole, waiting for them to stick their heads out.

The shaft continued upward. As he started up the ladder, there was a cry from below. Looking down past his feet, he saw the girl scrambling madly after him. He grabbed her hand and hauled her to his side.

"Those dead things!" she panted. "They're after us!"

A glowing skull pushed out of the tunnel below and two blazing eyes glared up at them through the gloom. Blue lips drew back in a hideous grin over phosphorescent teeth. A second skull face leered beside the first, and then a third. The great veins stood out in a ghastly network of cold blue radiance, gripping their craniums like groping roots burrowing under their translucent skin.

Adams silhouetted the fat barrel of the slug gun against the first grim shape and shoved down the firing stud. A hail of death whined down the shaft, smacking into glowing flesh, crunching through brittle bone. Gouts of the blue ichor spattered the steel walls—but still the glowing things came on. Whatever the unholy life-stuff that filled them, it gave them something mighty close to immortality.

The gun was empty. He flung it in the face of the foremost of the climbing things and dived into the tunnel, smacking into the girl and sending her sprawling. Rudely he grabbed her arm and shoved her ahead of him.

"Listen!" he snapped. "Those blue devils mean business and they can't be killed. Give me that light and get going!"

LIKE FRIGHTENED mice they scrambled through the maze of interlacing ducts through which the city's air supply was pumped. Up—down—back and forth from level to level until Adams had lost all track of his whereabouts. So long as they kept on climbing they were headed for the middle of things and their only chance for an out, but all the time the blue death hounds were creeping silently on their trail, following every twist and turn with uncanny prescience.

Without will of their own, controlled by the little cubes at the base of their brains, the automatons could go only where they were sent. Who was directing them in this hare-and-hounds chase through the bowels of the metal city? How could they follow his every move without an error? There must be something, somewhere, that was betraying him.

The touch of cool air on his moist skin suddenly gave him the answer. These ventilating shafts must have signaling devices to warn the blacks when gas or smoke seeped into the city's air supply. He turned his light on the wall. They should be here, close to the intersection. He found them—little disks of shiny black enamel set in the steel wall, and opposite them a lens which focused an invisible beam on the photosensitive "eye." He thought he could feel a slight warmth on his cheek as he squatted in front of the lens.

"We've been saps," he told the girl. "We've been signaling headquarters every time we passed an intersection. No wonder they've stuck to us like a hangover! We've got to get out in the

open again, quick, before someone uses his head and turns gas in on us."

He threw the light beam ahead. There was another outlet just beyond the intersection. There would be rooms out there where they could hide.

"Come on," he ordered.

Dousing the light, he squirmed feet first through the opening, kicked for a moment in emptiness, and dropped with a thud on a floor ten feet below. A second later the girl landed heavily on top of him, and they rolled with a crash against the wall.

A line of light began to widen on the opposite wall. Winded, Adams lay on his side, his fingers touching the butt of his one remaining gamma gun. Beside him he could hear the girl's bated breathing. Seconds turned into minutes and his eyes grew accustomed to the darkness of the place. Adams breathed a long sigh of relief. The jar of their fall had opened a loosely fastened door.

The situation seemed familiar. A puzzled moment, then suddenly he had it: "Death Below Ground." Billingsley Shropford, pursued by the subterranean monsters of Mercury, plunging without warning into the midst of their buried city. Shropford had had to think fast—

He looked quickly around him. They were in a small storeroom, heaped with boxes taken from the captured ships. His fingers nursed the gun butt again. If this didn't work, they were in for nastiness.

Swinging the door wide open he peered into the corridor. It was empty. Good! The girl was at his shoulder as he stepped back into the storeroom. She was tall, he found; standing beside him, her head was level with his eyes.

"Before we go any farther, we ought to know each other," he said. "I told you my name—the gang around headquarters mostly call me 'Atom' for short. What's yours?"

She ignored the question. "Aren't you being just a little sanguine?" she asked. "They know what detectors we ticked off last. Those blue things are probably right on our heels."

He beamed down at her. He liked her voice as well as her eyes and her hair and all the rest of her. "That's right," he approved smugly. "Can't be too careful. Suppose we give 'em a taste of Grade A strategy and then settle down and get acquainted."

PULLING the boxes away from the wall he made a space where they could crouch, behind the opened door. Barely had they clambered into their hiding place when they heard a muffled sound from the air duct above. Adams' muscles tautened. Something dropped to the floor—another and another. There had been six of the things on their trail!

The ghastly blue radiance from the things' naked bodies seeped through the crevices in their barrier of boxes. Adams squirmed around until he could apply his eye to the crack and get a view of the room. A glowing skull face passed across his field of view, hideously torn where his slugs had ripped into it, dribbling blue blood-stuff. Another, and then another—all six of the creatures stalked noiselessly past him and vanished through the open door. A minute passed, and another, before he dared to move. Sliding a box aside, he poked his nose into the crack at the hinge of the door. The girl's hair tickled his chin as he peered into the corridor.

Spread out from wall to wall, the six dead things were stalking toward the ramp leading up into the heart of the city. Like marching marionettes they trudged up it and disappeared.

Adams mopped his brow with a woolen sleeve. "Whew!" he breathed. "Lucky those mugs are dummies."

He heard a giggle behind him. He turned, his eyebrows cocked inquiringly, just as the girl burst into helpless laughter. She gripped her side, bent over

and howled. Tears ran down her cheeks and she wabbled on her feet. Adams looked slowly down at himself and felt his ears turn red.

The Space Patrol insists that good old-fashioned woolens are the only thing that will keep the chill of space from the tender hides of its young hopefuls. They have long, furry arms and long, lank legs, and all the ample anatomical accommodation worked out by other men of action centuries before. Space hogs call them "gee-gees," which an owl-eyed young instructor of etymology once described as being out of G string by amplification.

There is a reactionary school of thought among some of the more senile members of the Patrol, which holds that a man's gee-gees should be white, or as close to it as circumstances will permit. On the other hand, there is a very strong clique among the younger bloods which maintains that no one with hair on his chest and stubble on his chin can wear anything but red.

The gee-gees in which Adams stood revealed were somewhere between the color of a dry-land sunset and an overripe tomato. Their arms were long, but his were longer, and their baggy-kneed legs disappeared into his unlaced high-tops. To boot, his nose and face were peeling from the blast of ultra-violet he'd turned loose when he blew his way into the city.

He glowered savagely. "You're no treat yourself," he reminded her. "Those things used to fit *me,* but look at 'em now! Any time you don't like the way I look, I'll swap you even and throw in a couple of safety pins to keep you decent!"

A flicker of anger lit up the girl's eyes, to be replaced instantly by a smile.

"I'm sorry," she apologized. "I'm really grateful, but you *are* funny, you know. I've seen pictures of those things in the histories, but I never dreamed men still wore them." She held out her hand. "I'm Patricia Norton—and my friends call me Pat. Shake on it, Atom?"

"Sure!" He pumped her arm heartily. He stood flabbergasted when her eyes closed, her face went pale, and she slumped in a heap at his feet.

He kneeled and tucked an arm under her waist. Apparently she'd only fainted. After all, she'd had it plenty tough from the start. He'd be the lousiest kind of heel to drag her into any more. Only—neither could he leave her. Not in this den of wolves! If only they had spacesuits! Once in the old *Ourobouros* he'd undertake to keep hidden until hell froze over.

SHE STIRRED in his arms and her eyes opened slowly. He wondered whether she had seen the worried frown on his face. He squirmed inwardly, hunting for something to say.

"Look," he blurted. "What I mean —look."

She sat up and took his hand. "I'm all right," she told him. "After that . . . in the *Trixton* and after . . . anything else is a picnic. Keep me with you . . . please . . . and"—her eyes hardened—"we'll give those black devils a taste of what's coming to them!"

He dug his fingers into his hair. "Look," he said slowly. "You were on the *Trixton.* What happened? Where are we, anyway?"

"What do you mean?"

"When we went through that yellow glow we came out—somewhere else," he told her. "The stars are strange. There's a red dwarf out there where the Sun ought to be. I thought maybe the *Trixton* went into it slower, and you'd seen something that would help."

"I was in my cabin, dressing. It . . . it was as though the bottom fell out of the world. Like falling, only without any end. There was a sweetish odor—some kind of gas, I think—and when I woke up again one of those yellow-

headed blacks was sticking a needle into my arm. When I came to the next time I was back there—where you found me."

He nodded. "That glow has something phony about it. The whole setup is nuts, any way you look at it. It makes my head ache to think about it. Suppose we don't."

"Have you a better suggestion?"

"Hm-m-m . . . couple of them. I've got a ship out there, only without suits we can't leave this damned tin city. There have to be suits somewhere—either ones they've taken from the ships they've cracked, or those skin-tight glass things they wear themselves. If we can find a couple, and figure a few answers to what's been going on, maybe we can spike their pretty little game for good and all."

"That's one," she said. "I like it. What about the other?"

"It's really both," he told her. "First we get the suits. I don't see any here, but there may be other storerooms. Then we walk right on out the front door—if we can. And if we can find out what make the Glow work, we'll let it take us right back where we started from. O. K. by you?"

She wasn't listening. She was staring over his shoulder into the passage. Her fingers tightened on his arm. "Atom," she murmured, "turn round—slowly."

He turned his head. The corridor was empty. "What was it?" he demanded.

She shook her head. "I don't know. But there was . . . something. It had no shape, really. It just . . . shimmered . . . like a mirage in the dry lands. I could see through it, but when it moved I could tell where it was. It went that way . . . up."

He stared at her for a moment. "I guess you're getting the jumblies," he decided. "Sometimes they're pink, with spots. It's the effect of gravity on the eyes or something. Anything I can see through I can walk through—like this door. Come on."

The city seemed deserted. The effect of the centrifugal force lessened as they neared the axis, and they had to move slowly to keep from bounding into the air like toy balloons. What was more to the point, every door they came to now was locked.

Pat stopped, finally. "We're not doing so well," she said. "There isn't even a place to hide if someone comes along. Why don't we go back till we find an open room, then try to get into one of the storerooms through the ventilators? They'll know where we are again, but we may find what we want and be gone by the time they get to us."

"Sure—and we may not. O. K., I'll try anything once, *if* I can't find a good substitute." They retraced their steps to the ramp they had just climbed. It rose from the lower levels at a junction of passages. Adams reached it and stopped short. A steel door had rolled across the entrance.

The girl was at his elbow. "Atom—they know we're here! What are we going to do?"

"Think!" he told her curtly. "We've got brains; let's use them. If there's an open door anywhere here, we can take to the ventilators again and do like you said—head for a storeroom, get suits, and beat it for the *Ourobouros*. If there isn't—well, I've got a hunch. They'll send the dead men after us first, and when they do, try for those little cubes on their necks. Those are the things that keep 'em ticking, and they may be what will stop 'em."

CAUTIOUSLY they moved along the corridor, trying the doors on both sides. The passage was like the bottom of a huge U tube, curving upward out of sight before and behind.

"Where do these cross-passages go?"

Pat inquired. "There may be other ramps."

"There are," he agreed. "Plenty of them. But if they can track us here, they can do it there. We've got to outguess them. It's like in chess—playing for a stalemate—only we don't know what pieces the other guy has, and we can't see his moves."

"Listen!" She caught his arm. Faintly, more as a vibration than a sound, came the tread of marching feet. The robots! They were somewhere there ahead.

"Atom!" It was a wail of fear. He spun on his heel. One of the steel bulkheads had slipped silently across the passage behind them.

"Atom—look!"

Something moved at the entrance to the cross-passage, close to the steel barrier. Something like a colorless flame—a puff of swirling gasses—flickering and swirling in the dim light. It paused—and was gone. Where it had been he could see only the cold gray steel. Then he glimpsed it again, nearer, moving toward them.

Better the known than the unknown! He raised his gun slowly, but it was gone again. It was standing still. Let it move and he'd nail it!

Naked feet slapped on the steel floor. He spun, sweeping the girl behind him. They were there—grinning blue files of them, blocking the passage from wall to wall.

"Pat," he called, "run for the cross-passage. We can hold them there."

They were close. He hugged the left-hand wall. Only an angle shot could hit their neck cubes at this range—that or one straight through their scrawny necks. He took careful aim and squeezed. One! That did it! Again and again. He had their number!

Then Pat screamed: "Atom! *Atom!*"

"Pat!" To hell with dead men! He began to run down the corridor. A little group of blacks stood in front of the barrier. The white-haired giant was with them. And they had Pat!

They'd never keep her! He raised his gun.

"Adams! You'll hit her! Come here."

It was a man's voice—speaking English. But there was no one there! Something flickered before his eyes—a hand seized his arm and swung him about, pressed him close to the wall. "Quiet!" the voice hissed.

A black curtain slipped down before his eyes. He was in utter darkness—darkness blacker than anything he had ever imagined. Yet he could hear and feel—the thud of approaching feet, the cold steel against his back, that hand gripping his arm. Something brushed past before him, then he was being pushed slowly sidewise, along the corridor. The robots were marching past there beyond the dark curtain. And Pat—where was she?

He struggled to be free. The fingers bit savagely into his arm; the voice hissed in his ear:

"You fool! They'll see us—get us both! You can't help her now. I'll get you your chance at Baldar later, when you'll stand a chance."

He felt a door jamb at his back. As his shoulders pressed against the steel panel, it opened; he heard it clang shut in front of him and the pall of darkness rolled up and left him staring bewilderedly about him.

THE ROOM was part laboratory, part living quarters. A tumbled bunk was against the wall; there was a metal table with opened cans of food, and a water cylinder. Most remarkable of all was the huge lead ovoid that stood on stubby legs against the far wall, with a door like a double-weight air lock standing open, revealing a complicated instrument board and massive bus bars inside.

He saw, too, the man who had brought him here. He was not quite Adams' height, and considerably older. A volu-

minous black cloak with metal strands running through the closely woven fabric was flung about his shoulders, and a cowl pushed back from his graying head.

All the suppressed powers of Adams' fertile imagination rushed into action. Here was the master mind—the mad scientist—the despotic renegade who lorded it over the lesser villains with whom he had already done battle. Here was the fiend he had been hunting for!

The man was smiling broadly. His big hand was thrust out. "Mr. Adams, isn't it?" he inquired gently.

Adams went white. "You rat!" he gritted—and swung.

Three dull thuds jarred his brain pan. The first was the smash of a fist against his jaw. The second was the wallop of his head on the steel floor. The third came when he was lifted by the belt and dumped on the floor of the lead egg. He realized dimly that the other man had climbed into the machine after him and closed the massive door. Then for the second time in his life the bottom dropped out of everything and he went spinning down a spiral roller coaster with the brakes off and nothing to hang on to.

He struggled to get to his feet, but his legs weren't working. He lay on his face and wished the world would end. There was a jar, and a long, blissful quiet, and then something dug into his ribs.

"Get up," a voice said.

He came fighting. He got in one blow that glanced off the other's cheekbone, and then that big right fist caught him again on the jaw and he went down and out.

ALL THE bubbling milk of human kindness had gone out of the Rutherford Bohr Adams who stood morosely at a window some hours later, staring out over a fantastic landscape. Huge tree ferns and barrel-trunked cycads grew in rank profusion along the shores of an oily sea. A blanket of mist lay over them, hiding the sun. As he watched, something huge and black came winging awkwardly across the jungle. It dipped low overhead, and he had a momentary impression of vast leathern wings and grinning, pointed jaws before the thing swung off toward the line of low red cliffs that bordered the sea.

The place he was in was built like a fortress, with red stone walls five feet thick, and set on a spur of rock overlooking the lowlands. It might have been built back in the dim dawn of civilization, but inside it looked like the pipe dream of some la-de-da futurist from the art schools. The place gave him the willies. He wanted to get out.

For the dozenth time he craned his neck out over the sill and took stock of things. There was a sheer drop of thirty feet to the top of the trees. Besides, down there in the shade of one of the great ferns was a something that might have been a mass of weathered rock if it hadn't moved twice in the last hour. Presumably it had a head and legs and an appetite. He wasn't in any mood to find out.

He mulled things over in his aching head. If only he could get his hands on the big guy with the right hook—just once more! That punch wouldn't fool him again. And with the big shot where he wanted him, maybe the lesser fry would listen to reason. But—how?

There was just one thing in the room that was both detachable and portable—a nice, shiny lamp stand that fitted his fist nicely and gave him a distinct feeling of superiority. Dragging a chair over in front of the door he sat down to wait, with the lamp across his knees. The dizzy whirl in his brain began to move slower, and the ache died away. Presently he was asleep.

The opening of the door woke him. Catlike he was on his feet. The big shot stood there. There was a woman with him—tall, with jet-black hair and burn-

ing black eyes, wrapped in a clinging silver gown. Behind them stood a circle of hawk-faced men—men with snowy white hair and pear-shaped heads—men like the white-haired devil in the metal city!

This time there was no mistake! He'd found the center of things!

With a yell of rage he leaped, swinging his lamp. Instantly the stuffing went out of him. The strength trickled out of his arms, his knees wavered and bent, and he dropped in a gangling heap at the woman's feet. She stooped and

The spinning dizziness left him slowly, the coiling, twisting memories of what he'd learned dying down to reality.

picked him up as though he were a baby —he, Adams! She carried him across the room and dumped him on a divan.

"Terree," she said, "come and tell him."

The big shot sauntered over to him. He had a little black cylinder in his hand and a grin on his strangely young-looking face.

"My wife thinks we owe you some explanations," he remarked. "Think you can behave if I let you up?"

ADAMS merely glowered. He shrugged and flung himself down in a chair, and the little cylinder still pointed carelessly at the recumbent patrolman. "O. K. by me," he said. "I can talk better if no one's interrupting me. When I'm done, you can do what you want about it.

"I guess you want to know what the hell goes on. Well, right now you're back on Earth, about where Kansas ought to be, only the time is something like sixty million years before you were born. That metal city was built another sixty million years after your time. Past and future—and our job is to keep the two of them apart!

"The whole screwy mess started with me, in a way. I was a physicist—Terence Michael Aloysius Donovan, D. Sc. —back in the 1930s. I figured out a nice, pretty theory about how time works and cooked up a gadget that proved it. It's coiled—time is, I mean—kind of like a spiral spring, with sixty million years between the turns. If you're a louse out for a crawl on the spring, you can follow along the wire, round and round till you die of old age, or you can climb over onto the next coil and take all that time in one lump. Forward or back—it's all the same—only it has to be just one coil at a time.

"Once I had it all figured out on paper I got busy and made me a sort of lead egg that would skip over from one coil to the next when you pressed the button. You were in one of its great-grandchildren. Well, I climbed in and —zowie!—I was back here in the middle of the Cretaceous Age, with the dinosaurs and the pterodactyls. And first thing you know I ran into Lana here.

"She and her people belonged on Mars. There were two races—the whites and the blacks—and as far back as history went the blacks had been the underdogs.

"I guess politics is the same anywhere you find it. Anyway, Lana's father, who was the hereditary ruler of the whites, died and Lana was in line for the job. Only she was a woman, and there hadn't been a woman ruler since before the canals were built. The politicians got together and put up her half-brother, Baldar, as a substitute, and then asked her to get out. Only she wouldn't get. So Baldar—the big guy you saw in the city—made a lot of promises to the blacks, and in no time they had as nice a little race war as you could ask for.

"That's where I popped up. Lana and a few of the people she could trust were hiding out on Earth, trying to get the remnants of the white forces together. When his revolution got out of hand—which was pretty soon—Baldar had come around begging for a new deal, so he was with them, too.

"So here came Donovan, out of the twentieth century, right into the middle of everything. I couldn't speak the language, but I helped Lana and her gang lick hell out of some of the blacks who had found them, and then I asked, please, could I go home and keep a date I had with a professor who didn't believe in time machines.

"Well, they didn't know me from Adam, and they'd just lost a tidy number of men trying to keep their hideout a secret, so they said 'no dice.' Being bullheaded Irish, I wouldn't take 'no' for an answer. I grabbed Lana for a

hostage, and lit out for the Time Egg. Her men hopped into their rocket and followed—and right then Baldar got off the fence and tried to ray both of us out of the picture.

"We reached the Egg all right, and I went back to 1937 and picked up some stuff we needed, and arranged with Professor Belden to get us both through. You see, the first Egg was just an experimental model and wouldn't hold more than one of us at a time. I went back for Lana, and Baldar found us.

"In a couple of seconds the Egg was a puddle of hot lead, and we were running for our lives. Then one of Mother Nature's little darlings heard the ruckus and came over to investigate. So there we were—Lana and I—out on an open beach with a gorgosaurus loping after us, and Baldar up in the sky with a heat ray, trying to do his duty as he seen it. We have Zanar, here, to thank for being alive. He was younger and a lot smaller then than he is now. He got into the control room through a conduit for power cables and put Baldar out of business just in time to turn the ray on the brute that was chasing us, and that was that. I was stuck sixty million years in the past, with no Egg and no way of knowing what kind of hullabaloo I'd blundered into.

"That's how I came to be mixed up in it all. Baldar got away and went over to the blacks, but Lana was all right and we managed to drum up reinforcements and give 'em something to think about. After I got so I could talk their language, we tried some hunches I had, and the result was the Golden Glow.

"It's another form of the space-time field that I use in the Egg to bridge the gap between the coils of time. Part of the energy that you pour into it leaks out again as yellow light. With the mass-energy that Lana's people had, and some of my own little gadgets, we rounded up the blacks and shot them through two full turns of the spiral, one hundred and twenty million years ahead. I figured they'd be out of our way, and probably clear of anyone who came after us. If they managed to keep alive, more power to 'em—maybe it would keep them out of mischief if they had to scrabble for a living.

"That was two hundred years ago. Sure, I know it sounds like a pipe dream, but Lana's people have a radioactive compound that they inject into the blood stream to keep the cells young and healthy. Take me—I'm going on two hundred and forty-five and I feel like thirty. Lana won't tell me how old she is."

DONOVAN grinned. "That's the first half of the yarn," he said. "Suppose we declare a truce for the rest." He laid the little cylinder on the table at his elbow. Adams swung his legs off the couch and sat up.

"Go ahead," he said. "I'm listening. Only it's got to be good."

"It was good for Baldar and his gang, anyway," Donovan replied seriously. "He went with the blacks into the future, of course, but no one figured he'd be dangerous at that distance. I still don't think so. Some of those blacks were smart, and once they had the idea and plenty of time they could work out a lot of things.

"The way I see it, they landed somewhere and dug in until they were sure they could keep alive. Then they built that metal city. It's in a Trojan orbit, equidistant from Venus and the Sun. And then they started to puzzle out a way to get back at us. With Baldar egging them on, they never had a chance to let down. Anyway, in the end they found the Glow and started in to make them an army that would wipe us clean off the records of the universe.

"From what I saw in the city, they must have been raiding your world for quite a while. They're using the same

blue stuff that keeps us alive to turn men and women into flesh-and-blood machines that can't die and have their will power burned clean out of them. They have some kind of radio control hooked into their nervous system so they do whatever Baldar and his dirty crew tell 'em to. There are thousands of 'em, and ships enough to hold them, and today or tomorrow or the next day they'll be coming at us through the Glow, and we won't have a Chinaman's chance to stop them."

He rubbed his chin thoughtfully. "That's how it is," he finished. "Baldar came through once in an Egg, to spy out the situation. Somebody recognized him, so I went after him in an Egg of my own that can ride the space lines as well as the time field. Within limits, you can put it about where you want to, in space as well as time. I found the city, got inside, and holed up in an empty room where I could see without being seen. With an invisibility cloak and a couple of snooping devices, I got the whole story before you and that girl came along. Only I'm stumped for answers. Any ideas?"

Adams regarded him owlishly. Time coils—invisibility fields—dinosaurs—it had him woozy! But it made a screwy kind of sense. He gulped.

"Gee," he said humbly, "I dunno."

The woman, Lana, had been standing at her husband's elbow while he talked. Now she bent forward eagerly. Her voice was deep, and it sent little shivers up and down Adams' spine.

"Meester Adams, you are from the future, from Terree's future, many years. Your science has advanced, maybe faster than ours. Is there nothing that your people know which will stop Baldar and thiss not-dead armee that he hass made? It must be your worree like ours, for Baldar will not be satisfied with one world, or one time. When he has taken his revenge on uss, he will look to your world and its plentee. Please—is there not something?"

Adams shook his head. "We've got plenty—sure—but nothing like the stuff Baldar has. Living dead men—rays that can paralyze a ship and bore into time—he has us covered a dozen ways. But I'll help you fight him with what you have."

Donovan smiled bitterly. "Thanks—but that's little enough. We could run, I suppose—on to your time or back in the very beginning of things—but he'd only follow. This is a grudge fight. I went ahead again, just once, after we had licked the blacks and I'd built another Egg, but everyone I knew was dead and the folks I met snickered when I talked about traveling in time. Old Belden never told what he knew, I guess, or maybe he wouldn't believe his eyes. Well—we'll have to sit tight and give 'em what we have. And may the devil be on our side!"

But Adams didn't hear him. He was remembering a tall, gray-eyed girl, dressed in an out-size uniform, struggling in the hands of a lot of grinning blacks. He was hearing her voice calling in desperation: "Atom! *Atom!*"

"I'm going back," he said. "Pat's back there. I've got to get her out. She'll be expecting me."

There was real sympathy in Lana's voice. "She means very much to you, thiss—Paat? She is a verree good friend to you?"

He flushed. "Well, in a way—she's just a girl I picked up there in the city. Baldar was after her, and you can't let a dame like that down. Anyway, she's a good egg—a damn good egg! I'm going back!"

Lana's hand was on Donovan's arm. "Help him, Terree. For me."

The big Irishman slid an arm around her waist. "Sure, darlin', I'll do what I can. He's a fool, but fools like us have luck sometimes."

FIFTY HOURS had ticked off on Adams' watch from the time when he first heard Donovan's voice speaking out of thin air until he hung, invisible, above the metal city, watching the massing of Baldar's army of the undead. Donovan's invisibility field diverted the visible waves of light and bent them around the wearer of the cloak. Only a slight distortion betrayed him when he moved. But the thing worked both ways—he could not be seen, but neither could he see. For this reason Adams carried a tiny televisor of Donovan's intention, shaped like a shallow bowl, which operated without a transmitter to show him any scene for which he set its focus.

The space armor Donovan had given him was self-powered, a miniature spaceship in which he could live for several days. It operated on the principle of the Time Egg, creating new geodesics in the space-time continuum and riding them as a comet rides its orbit. There was no rocket flare to betray him—nothing to show that he was hanging there, close above the assembling fleet, watching—and waiting.

One after another the stolen ships were being brought out of the metal city. The *Ourobouros* was there with the others, her ungainly shape unmistakable among the slenderer craft. Adams noted that Baldar had made no change in her armament, as he had with some of the other ships. Maybe he hadn't had time, or maybe Baldar had decided that armor which would turn a meteor was enough for any ship.

He had used them all. Ships as old as the *Lustris*—the most decrepit of freighters—the bright new *Trixton* with her super-powered motors—all had been sheathed in new, heavy armor through which winked the wicked little eyes of ray ports, and packed with the hosts of the dead-alive. Studying them with his televisor, Adams saw that even at the controls there were only robots, rigidly at attention, waiting for the command that would animate them and send them on Baldar's mission of revenge.

Nowhere could he see any of the blacks, and nowhere Baldar or Pat.

He was being a sap, he told himself disgustedly. The chances were that Baldar had sent her back to join the ranks of the living dead. But—what if he hadn't? What if she were still alive, down there? He couldn't let her down. Not Pat!

And then he saw it.

It was vaster than anything he had ever dreamed of. It rose out of the central shaft of the city and moved slowly out through the swarm of smaller ships. Long, tapering, freckled with the shining dots of ray ports, Baldar's flagship was the mightiest craft ever made for flight in space. She must have the geodesic drive, Adams knew, for nothing else would give so vast a ship maneuverability in battle.

Feverishly he adjusted the televisor to study the ship's interior. The reason for the cigar shape was evident at once. Space-tight bulkheads divided it into independent units, each with its own drive and its own armaments. Like the Hydra of old, it could be cut to bits and still go on fighting.

From more than a mile at the middle, the flagship's diameter tapered to blunt points at either end. And in the foremost compartment Adams found what he had been looking for.

Baldar—and Pat!

THE HAWK-FACED giant stood spraddle-legged before a vast instrument board, watching the assembling of his fleet. Three of the blacks were with him, seated before low keyboards, but Adams had no eyes for them. He saw only Pat, slumped despairingly in a seat against the wall, her face buried in her hands. She looked up—into his very face, it seemed—and her face was lined, her gray eyes weary and without hope. All the slim lines of youth seemed to

have gone out of her slender body and left her suddenly, hopelessly old.

Baldar's hand flew up. The ships had moved to form a cylinder about the axis of the city, with the flagship at its outer end. At their leader's signal the three blacks began a busy tapping at the keys, and instantly the fleet began to move.

Out from the city's axis plumed the Golden Glow. It passed through the cylinder of waiting transports, out almost to where the great flagship waited. And it changed!

Lacy threads of blackness were spun out of the yellow Glow. They coalesced, twined and knotted until an inky net enveloped the golden spume—enveloped it and drank it in, absorbed it utterly. A black hole seemed to have been bored in space—a tunnel of blackness into which he looked for interminable distances, and into which the ships were moving one by one—and vanishing!

Baldar had more than the Glow, then. Like Donovan, he could launch his transports directly through both space and time, and swoop down without warning on the unsuspecting Earth, a hundred million miles and more than a hundred million years away. His zombie army would swarm over Lana's citadel and crush it by sheer force of numbers. And here he was, helpless to prevent it—helpless to do anything but watch!

The Donovans were boastful of their Irish luck. The Adams clan were braggarts in their own right. But whether it was Old Lady Luck, with the spiked drink and the loaded dice, who whispered in his ear, or whether the spirit of Billingsley Shropford leaned out of the pages of some unwritten yarn and nudged him in the ribs, Adams could never say. Suddenly and surely he knew what he must do.

THE LAST of the transports were moving into the web. The old *Lustris* was there, and behind her the ungainly shape of the *Ourobouros*. Not for nothing had all Donovan's skill gone into the suit that Adams wore. New-made space and time carried him like a falling star into the dredge's path. He might have been seen in that moment, as the stuff of space rippled around him, but no one was looking. Then he was safe inside the great ship's yawning funnel as she began her long, twisting slide through a hundred and twenty million years.

This was the fourth time that Adams had been over the bumps. It left him sick and giddy, fighting desperately to keep his senses, swimming drunkenly in that sea of light and sound that had no beginning and no end. Then they were through, and Earth with its strangely shaped continents and its warm Cretaceous seas lay under them—Earth, where Donovan and Lana and a handful of the white Martians were making their last hopeless stand.

He began to work his way along the armored gullet of the dredge, into the shelter of the great bulb. Here was the lock opening into the stowage chambers, through which he had escaped two days before. Once inside the fun was going to begin!

Adams had had all the fire of a youthful imagination bright within him the day he took command of the dredge *Ourobouros*, and a full shelf of the exploits of Billingsley Shropford safely stowed away in his locker. His nimble wit envisioned certain improvements which the brothers Pastura might have looked upon with scorn, and in his spare time, while the dredge was sweeping space without benefit of a pilot, he had done a little tinkering with its *modus operandi*.

When Baldar's motley fleet began to drop out of the sky over Donovan's lonely citadel, Adams was worming his way between the inner and outer armor of the dredge, making for a sealed-off space directly under the floor of the control cabin. He did not see the army

of living dead pouring out of the ships, or see them swarming over the fortress through Donovan's barrage. They could not die—they could only be destroyed—and while Lana's grim kinsmen picked them off, one by one, Baldar's mighty flagship poked its nose through the black core of the time chute and began to ray the citadel with all the power of its colossal generators.

They were evenly matched, those two. Had Baldar had time to complete the arming of his robots and convert the captured ships into real fighting machines, things might have been different. Nor did he reckon with Rutherford Bohr Adams and the dredge *Ourobouros.*

Like a tick under the ship's thick skin, Adams was working his mischievous way with the fate of worlds. A moment before Baldar appeared on the scene he had diverted the dredge's power to his own hidden control panel. The robot crew still went through the motions of control, obeying the impulses transmitted to the little black cubes that tapped their brains, but the controls in their skinny hands were dummies. Snug in his secret burrow under their feet, Rutherford Bohr Adams was once more master of the *Ourobouros!*

The screen he had built from odds and ends of spare parts showed him Baldar, driving down at the beleaguered citadel with a shaft of dazzling energy blasting its way before him. With a grin that almost slit his ears, he slid the massive dredge into the flagship's path. The gadget that drove his spacesuit—Donovan's superdrive—was wired into the innards of the *Ourobouros,* and while it held, there was going to be fun on Earth!

DEEP in the armored cells under the fortress, Donovan saw the dredge swerve from its course and his howl of Irish glee brought Lana and the others running to his side. They saw the two ships meet—the nose of Baldar's monster crammed tight into the gaping gullet of the dredge. They saw the blast of shearing flame that burst from the side of the *Ourobouros,* cutting through the body of the flagship and leaving it blunted, noseless, spinning with the shock of the explosion.

Adams was scrambling for dear life back through the tortuous bowels of the dredge when the geodesic drive let go. The explosion hurled him headlong into a crossbrace and he felt the grate of broken bone in his side. But something quite beyond his control was driving him now.

Baldar's ship had rammed head-on into the maw of the *Ourobouros* like a silver lizard half swallowed by a giant frog. As Donovan's potent little gadget reached its limit of endurance every erg in the dredge's power house ripped loose in a fountain of annihilated matter that lopped the forward compartment neatly off Baldar's ship and blew the next three sections into kingdom come. Jammed in the armored belly of the dredge, with the wreckage of the great funnel folded around him, Baldar could only pull his crippled fragment of a ship out of its headlong dive and blast out with all the ray power left him, trying to melt his way through by brute force. One of his three aids was sprawled on the floor with a cracked skull and the other two were staring at him with utter panic on their black faces. In the body of the flagship a score of black officers were trying desperately to send the remaining compartments in a score of different ways, and forgetting entirely that they were fighting a war with blue-veined proxies that had no will of their own.

Baldar saw his handsome flying juggernaut wrench itself to pieces and rain in fragments on the treetops, under the fire of Donovan's rays. He saw his living dead men roaming helplessly or standing waiting for a command. And Baldar lost his evil temper.

Pat Norton had been flung clear across the chamber by the crash. She picked herself up, to see Baldar, his face twisted with rage, standing over one of the black officers. There was blood on his big hands, and the balls of his slitted eyes were red as glowing coals. She saw the second officer fumble for his gun and saw Baldar shoot him down and pump slug after slug into his prostrate body. Then he was stalking toward her with rank madness in his face.

That was where Adams butted in again.

Baldar's first blind barrage of rays had nearly cooked his goose. It blew holes in the double armor of the globe and sprayed him with molten metal as he lay hugged against the wreckage of the flagship. Then it stopped, and picking up the steel bar he had dragged behind him for what seemed an eternity, he jammed it savagely down the nearest ray port, through lenses, focusing coils and all, and churned it violently until hot air puffed out in his face.

They were low now, and there was little difference in pressure between the ship and the atmosphere. Adams poked his head into the midst of the wrecked ray port, and rammed his shoulders after it. He found purchase for his knee, and then a foot, and then something gave and he was flat on his face on the floor of Baldar's control room with a fat-nosed pistol directly in front of his nose.

He struggled to his knees, sick with the pain of his cracked rib. Through a red mist he saw Pat, hammering with clenched fists at Baldar's cruel face. The giant's fingers were on her throat, his thin lips twisted, his black eyes blazing with fury. Then he had the slug gun, he hurled it with all his strength at the huge white head and staggered after it.

The gun glanced harmlessly from Baldar's shoulder and crashed against the wall. The giant turned, barely in time to meet the other's charge. Adams kicked out with steel-shod feet, and they went down together, the Martian's fingers clawing at his armor. They rolled against the wall and stumbled to their feet again. They stood a moment, swaying face to face, then Baldar had seized him and was battering his helmet against the steel wall of the cabin. Foam flecked the giant's thin red lips; hell-fire burned in his mad eyes. He kicked out and saw the other flinch, then with all his strength he smashed his mailed fist between the Martian's eyes.

That pear-shaped skull burst like an egg. Adams stood with blood and clotted brains dripping from his hand, staring dumbly down at the broken form, and knew that the girl—Pat—was tugging at his arm and calling to him. He felt a mighty blow as the masterless ship lunged into the ground. And after a long, long time he saw Terry Donovan's Irish face grinning at him, and Lana's coiled black hair, and the blank white faces of a circle of silver-haired giants, and heard their voices, dimly, as if very far away.

RUTHERFORD BOHR ADAMS stood stiffly at attention in the very private office of the Space Patrol's Brass Hat. His blond curls were tousled, and his neck and ears were red, and he had a very undignified smear of red across his mouth. He stood and squirmed inwardly while the Brass Hat told him what he thought of him and his crackbrained stunt of cracking up the biggest and newest ship Pasturas had made. He was no happier because a gray-haired Irish giant stood behind the Brass Hat's chair with a smile on his humorous mouth, or because a tall woman with very white skin and very black hair was staring at him absorbedly. And it didn't help at all to have a slim-bodied, gray-eyed, red-mouthed slip of a girl with hair like fine old mahogany sitting on the arm of the Brass Hat's chair with one arm around his bull neck and a silk-

clad leg swinging jauntily.

The Brass Hat stopped bellowing and came up for air. The purple hue gradually drained out of his jowls. An almost genial look spread over his granite features.

"Well, Adams," he snapped, "speak up! What have you to say for yourself?"

Rutherford Bohr Adams grinned happily. He knew this situation by heart, from "Death Over Deimos." Billingsley Shropford was standing before the World President—

"Nothing much, sir," he admitted. "I guess you've said about everything that anyone could think of. Only—there is one thing. If I could have my furlough now, we . . . I mean your daughter and I . . . could get to see something of the System before the Pasturas get the new dredge off the ways. You know . . . on our honeymoon." His grin broadened. "It . . . it was Pat's idea."

He saw the tide of purple rising again in the Brass Hat's wattles, but he had Pat's slim fingers in his hand and an arm curled comfortably about her waist. He listened calmly while old Norton blew off steam. In "Death Over Deimos" Billingsley Shropford had spurned the World President's offer of his daughter and half a million. He'd had his career to think of, and a man of action couldn't have a career and a wife, too. Besides, through close to a score of volumes now, Shropford had been true to the memory of his one great love, the dame who had fallen for some other guy while he was chasing crooks on Jupiter Nine. Billingsley Shropford was like that—a great guy.

But hell—these detectives didn't know everything!

LABORATORIES AREN'T PLAYFUL

The "Voder," now on demonstration at both the San Francisco and the New York World's Fairs, was developed by the Bell Telephone laboratories. But laboratories are not given to playfulness, nor to the production of instruments costing tens of thousands of dollars serving only for the passing amusement of those who happen to attend the fair.

The Voder is a product of definitely aimed research that, when completed, will introduce to the world a completely and uniquely different means of communication, as different from telephony as telephony is from telegraphy.

The human voice requires, for clear transmission of intelligence, a band of frequencies some three thousand cycles wide. That means that telephone lines carrying a single voice message must be designed, throughout, to carry frequencies as high as three thousand without distortion. Further, and more important, it means that when carrier wave—wired wireless, so-called—is used, each band of carrier wave sent must allow for that three-thousand-cycle width. The difficulty of long wire-line design makes it economically impossible to carry more than about ten speech bands on one circuit.

The Voder, by operation of a comparatively few keys, can synthesize human speech. The keys, or controls, could be operated electrically, from a distance, of course. And the fluctuations required of those controls, in synthesizing voice, are quite slow—no more than three hundred cycles would be required to handle the key-control impulses.

Suppose, then, that we set up in New York an analyzer that breaks down John Jones' voice into basic constituents, and variations in those constituents. Then, instead of sending electrical waves corresponding to his voice, we send to San Francisco electrical waves corresponding to the Voder-control impulses necessary to exactly synthesize his voice.

Presto! Instead of three-thousand-cycle currents, we need handle only three-hundred-cycle currents for each speaker—and one circuit can handle ten times as many Voder-control messages. That means that much more apparatus will be needed—the voice analyzer in New York that translates voice currents into Voder-control currents, and the Voder apparatus in San Francisco that reverses the translation to exactly reproduce the voice. But—we will need only one tenth as many poles, one tenth as much construction work—and one tenth as much maintenance work on some three thousand miles of wires.

And it would introduce a completely new method of communication, neither telephony nor telegraphy, but a strange hybrid possessing the clarity and swiftness of telephony and the narrow channel and resistance to distortion of telegraphy.

Laboratories aren't playful—but they do stumble on amusing gadgets on their way to a very definite, important goal. The research is going on, and will eventually lead to a perfected analyzer and Voder synthesizer that will give clearer, cheaper transcontinental communication.

Arthur McCann.

FIRE-MAKER

MAN'S rise above the beasts probably started with the invention of weapon, the fundamental tool. But Man's rise toward civilization started with the discovery of fire. From that day on, the making of fire has been one of the keenest problems, solved finally by Western civilization only about a century ago with the perfection of the chemical match.

The vast importance of fire making to primitive man is indicated in the frequent ceremonies involving extinguishing the ever-burning fires periodically, and proving the civilization of the tribe by rekindling fire.

Only with the rise of chemistry did white men get away from the two primitive methods, methods based on discoveries of stone-age Man: friction and percussion. Friction being hard work, it was discarded early, but flint-and-steel survived to within modern times. The match was the Western world's first reasonably sure, reasonably convenient method of fire making, and the first method dependent on something other than those two ancient principles.

The Polynesians had a far superior method that did not involve either of those two methods! It was a sound, scientific method based on the physics of gases, developed into a practicable, sure and simple apparatus that was convenient to carry. Furthermore, Western science has taken it over for its own use. It is, today, used as a fire maker throughout the world, but under special circumstances.

The Polynesian invention consists of a hardwood cylinder, bored part way through along the axis, the bore being carefully and smoothly finished. Into this, a piston fits snugly, a piston that ends in a mushroom-shaped head designed to fit the palm. The man using it puts a bit of fluff—tinder made by scraping some pithy wood plant—into the bore, putting the piston in on top, braces the cylinder on something firm, and sharply swats the mushroom head down. Presto! The air in the cylinder is compressed vigorously, is heated thereby, and the oxygen concentration per cubic millimeter raised. The vegetable fluff catches fire, and the Polynesian has his lighted tinder.

The glory of the thing is, it will work in a boat at sea with a high wind blowing, and spray falling all over the place. Try and do that with flint and steel! Or, for that matter, with a match!

Dr. Diesel is said to have gotten his inspiration for the Diesel compression-ignition engine from one such fire maker seen at an exhibition. But one of the most fascinating points of the little gadget is this: Europe waited till the chemist elaborated his science to the point of the match, while the Polynesian had a supremely simple, compact, and reliable fire maker.

Ingenious authors make fire for marooned men by bow drills, watch-glass condensing lenses and sunlight, even lenses of ice. The Polynesian compression ignitor recommends itself to marooned seamen. *Arthur McCann.*

THE DAY IS DONE

By LESTER DEL REY

THE DAY IS DONE

The last of a race dies before a deadly thing he could not see or fight. Heartbreak—!

By Lester del Rey

HWOOGH scratched the hair on his stomach and watched the sun climb up over the hill. He beat listlessly on his chest and yelled at it timidly, then grumbled and stopped. In his youth, he had roared and stumped around to help the god up, but now it wasn't worth the effort. Nothing was. He found a fine flake of sweaty salt under his hair, licked it off his fingers, and turned over to sleep again.

But sleep wouldn't come. On the other side of the hill there was a hue and cry, and somebody was beating a drum in a throbbing chant. The old Neanderthaler grunted and held his hands over his ears, but the Sun-Warmer's chant couldn't be silenced. More ideas of the Talkers.

In his day, it had been a lovely world, full of hairy grumbling people; people a man could understand. There had been game on all sides, and the caves about had been filled with the smoke of cooking fires. He had played with the few young that were born—though each year fewer children had come into the tribe—and had grown to young manhood with the pride of achievement. But that was before the Talkers had made this valley one of their hunting grounds.

Old traditions, half told, half understood, spoke of the land in the days of old, when only his people roamed over the broad tundra. They had filled the caves and gone out in packs too large for any animal to withstand. And the animals swarmed into the land, driven south by the Fourth Claciation. Then the great cold had come again, and times had been hard. Many of his people had died.

But many had lived, and with the coming of the warmer, drier climate again, they had begun to expand before the Talkers arrived. After that—Hwoogh stirred uneasily—for no good reason he could see, the Talkers took more and more of the land, and his people retreated and diminished before them. Hwoogh's father had made it understood that their little band in the valley were all that were left, and that this was the only place on the great flat earth where Talkers seldom came.

Hwoogh had been twenty when he first saw them, great long-legged men, swift of foot and eye, stalking along as if they owned the earth, with their incessant mouth noises. In the summer that year, they pitched their skin-and-wattle tents at the back of the hill, away from the caves, and made magic to their gods. There was magic on their weapons, and the beasts fell their prey. Hwoogh's people had settled back, watching fearfully, hating numbly, finally resorting to begging and stealing. Once a young buck had killed the child of a Talker, and been flayed and sent out to die for it. Thereafter, there had been a truce between Cro-Magnon and Neanderthaler.

Now the last of Hwoogh's people were gone, save only himself, leaving no children. Seven years it had been since

Hwoogh's brother had curled up in the cave and sent his breath forth on the long journey to his ancestors. He had always been dispirited and weak of will, but he had been the only friend left to Hwoogh.

The old man tossed about and wished that Keyoda would return. Maybe she would bring food from the Talkers. There was no use hunting now, when the Talkers had already been up and killed all the easy game. Better that a man should sleep all the time, for sleep was the only satisfying thing left in the topsy-turvy world; even the drink the tall Cro-Magnons made from mashed roots left a headache the next day.

HE TWISTED and turned in his bed of leaves at the edge of the cave, grunting surlily. A fly buzzed over his head provocatively, and he lunged at it. Surprise lighted his features as his fingers closed on the insect, and he swallowed it with a momentary flash of pleasure. It wasn't as good as the grub in the forest, but it made a tasy appetizer.

The sleep god had left, and no amount of lying still and snoring would lure him back. Hwoogh gave up and squatted down on his haunches. He had been meaning to make a new head for his crude spear for weeks, and he rummaged around in the cave for materials. But the idea grew farther away the closer he approached work, and he let his eyes roam idly over the little creek below him and the fleecy clouds in the sky. It was a warm spring, and the sun made idleness pleasant.

The sun god was growing stronger again, chasing the old fog and mist away. For years, he had worshiped the sun god as his, and now it seemed to grow strong again only for the Talkers. While the god was weak, Hwoogh's people had been mighty; now that its long sickness was over, the Cro-Magnons spread out over the country like the fleas on his belly.

Hwoogh could not understand it. Perhaps the god was mad at him, since gods are utterly unpredictable. He grunted, wishing again for his brother who had understood such things better.

Keyoda crept around the boulder in front of the cave, interrupting his brooding. She brought scraps of food from the tent village and the half-chewed leg of a horse, which Hwoogh seized on and ripped at with his strong teeth. Evidently the Talkers had made a big kill the day before, for they were lavish with their gifts. He grunted at Keyoda, who sat under the cave entrance in the sun, rubbing her back.

Keyoda was as hideous as most of the Talkers were to Hwoogh, with her long dangling legs and short arms, and the ungainly straightness of her carriage. Hwoogh remembered the young girls of his own day with a sigh; they had been beautiful, short and squat, with forward-jutting necks and nice low foreheads. How the flat-faced Cro-Magnon women could get mates had been a puzzle to Hwoogh, but they seemed to succeed.

Keyoda had failed, however, and in her he felt justified in his judgment. There were times when he felt almost in sympathy with her, and in his own way he was fond of her. As a child, she had been injured, her back made useless for the work of a mate. Kicked around by the others of her tribe, she had gradually drifted away from them, and when she stumbled on Hwoogh, his hospitality had been welcome to her. The Talkers were nomads who followed the herds north in the summer, south in the winter, coming and going with the seasons, but Keyoda stayed with Hwoogh in his cave and did the few desultory tasks that were necessary. Even such a half-man as the Neanderthaler was preferable to the scornful pity of her own people, and Hwoogh was not unkind.

"Hwunkh?" asked Hwoogh. With his stomach partly filled, he felt more kindly toward the world.

"Oh, they come out and let me pick up their scraps—me, who was once a chief's daughter!—same as they always do." Her voice had been shrewish, but the weariness of failure and age had taken the edge from it. "'Poor, poor Keyoda,' thinks they, 'let her have what she wants, just so it don't mean nothin' we like.' Here." She handed him a roughly made spear, flaked on both sides of the point, but with only a rudimentary barb, unevenly made. "One of 'em give me this—it ain't the like of what they'd use, I guess, but it's good as you could make. One of the kids is practicing."

Hwoogh examined it; good, he admitted, very good, and the point was fixed nicely in the shaft. Even the boys, with their long limber thumbs that could twist any which way, made better weapons than he; yet once, he had been famous among his small tribe for the nicety of his flint work.

Making a horse gesture, he got slowly to his feet. The shape of his jaw and the attachment of his tongue, together with a poorly developed left frontal lobe of his brain, made speech rudimentary, and he supplemented his glottals and labials with motions that Keyoda understood well enough. She shrugged and waved him out, gnawing on one of the bones.

HWOOGH wandered about without much spirit, conscious that he was growing old. And vaguely, he knew that age should not have fallen upon him for many snows; it was not the number of seasons, but something else, something that he could feel but not understand. He struck out for the hunting fields, hoping that he might find some game for himself that would require little effort to kill. The scornful gifts of the Talkers had become bitter in his mouth.

But the sun god climbed up to the top of the blue cave without Hwoogh's stumbling on anything. He swung about to return, and ran into a party of Cro-Magnons returning with the carcass of a reindeer strapped to a pole on their shoulders. They stopped to yell at him.

"No use, Hairy One!" they boasted, their voices light and gay. "We caught all the game this way. Turn back to your cave and sleep."

Hwoogh dropped his shoulders and veered away, his spear dragging limply on the ground. One of the party trotted over to him lightly. Sometimes Legoda, the tribal magic man and artist, seemed almost friendly, and this was one of the times.

"It was my kill, Hairy One," he said tolerantly. "Last night I drew strong reindeer magic, and the beast fell with my first throw. Come to my tent and I'll save a leg for you. Keyoda taught me a new song that she got from her father, and I would repay her."

Legs, ribs, bones! Hwoogh was tired of the outer meat. His body demanded the finer food of the entrails and liver. Already his skin was itching with a rash, and he felt that he must have the succulent inner parts to make him well; always, before, that had cured him. He grunted, between appreciation and annoyance, and turned off. Legoda pulled him back.

"Nay, stay, Hairy One. Sometimes you bring good fortune to me, as when I found the bright ocher for my drawing. There is meat enough in the camp for all. Why hunt today?" As Hwoogh still hesitated, he grew more insistent, not from kindness, but more from a wish to have his own way. "The wolves are running near today, and one is not enough against them. We carve the reindeer at the camp as soon as it comes from the poles. I'll give you first choice of the meat!"

Hwoogh grunted a surly acquiescence and waddled after the party. The dole of the Talkers had become gall to him, but liver was liver—if Legoda kept his bargain. They were chanting a rough marching song, trotting easily under the

load of the reindeer, and he lumbered along behind, breathing hard at the pace they set.

As they neared the village of the nomads, its rough skin tents and burning fires threw out a pungent odor that irritated Hwoogh's nostrils. The smell of the long-limbed Cro-Magnons was bad enough without the dirty smell of a camp and the stink of their dung-fed fires. He preferred the accustomed moldy stench of his own musty cave.

Youths came swarming out at them, yelling with disgust at being left behind on this easy hunt. Catching sight of the Neanderthaler, they set up a howl of glee and charged at him, throwing sticks and rocks and jumping at him with play fury. Hwoogh shivered and crouched over, menacing them with his spear, and giving voice to throaty growls. Legoda laughed.

"In truth, O Hairy Chokanga, your voice should drive them from you. But see, they fear it not. Kuck, you two-legged pests! Out and away! Kuck, I say!" They leaped back at his voice and dropped behind, still yelling. Hwoogh eyed them warily, but so long as it suited the pleasure of Legoda, he was safe from their pranks.

Legoda was in a good mood, laughing and joking, tossing his quips at the women until his young wife came out and silenced it. She sprang at the reindeer with her flint knife, and the other women joined her.

"Heyo," called Legoda. "First choice goes to Chokanga, the Hairy One. By my word, it is his."

"Oh, fool!" There was scorn in her voice and in the look she gave Hwoogh. "Since when do we feed the beasts of the caves and the fish of the river? Art mad, Legoda. Let him hunt for himself."

Legoda tweaked her back with the point of his spear, grinning. "Aye, I knew thou'dst cry at that. But then, we owe his kind some pay—this was his hunting ground when we were but pups, straggling into this far land. What harm to give to an old man?" He swung to Hwoogh and gestured. "See, Chokanga, my word is good. Take what you want, but see that it is not more than your belly and that of Keyoda can hold this night."

Hwoogh darted in and came out with the liver and the fine sweet fat from the entrails. With a shrill cry of rage, Legoda's mate spring for him, but the magic man pushed her back.

"Nay, he did right! Only a fool would choose the haunch when the heart of the meat was at hand. By the gods of my father, and I expected to eat of that myself! O Hairy One, you steal the meat from my mouth, and I like you for it. Go, before Heya gets free."

Tomorrow, Hwoogh knew, Legoda might set the brats on him for this day's act, but tomorrow was in another cave of the sun. He drew his legs under him and scuttled off to the left and around the hill, while the shrill yells of Heya and the lazy good humor of Legoda followed. A piece of liver dangled loose, and Hwoogh sucked on it as he went. Keyoda would be pleased, since she usually had to do the begging for both of them.

And a little of Hwoogh's self-respect returned. Hadn't he outsmarted Legoda and escaped with the choicest meat? And had Keyoda ever done as well when she went to the village of the Talkers? Ayeee, they had a thing yet to learn from the cunning brain of old Hwoogh!

Of course the Talkers were crazy; only fools would act as Legoda had done. But that was none of his business. He patted the liver and fat fondly and grinned with a slight return of good humor. Hwoogh was not one to look a gift horse in the mouth.

THE FIRE had shrunk to a red bed of coals when he reached the cave, and Keyoda was curled up on his bed, snor-

ing loudly, her face flushed. Hwoogh smelled her breath, and his suspicions were confirmed. Somehow, she had drunk of the devil brew of the Talkers, and her sleep was dulled with its stupor. He prodded her with his toe, and she sat up bleary-eyed.

"Oh, so you're back. Ayeee, and with liver and fat! But that never came from your spear throw; you been to the village and stole it. Oh, but you'll catch it!" She grabbed at the meat greedily and stirred up the fire, spitting the liver over it.

Hwoogh explained as best he could, and she got the drift of it. "So? Eh, that Legoda, what a prankster he is, and my own nephew, too." She tore the liver away, half raw, and they fell to eagerly, which she chuckled and cursed by turns. Hwoogh touched her nose and wrinkled his face up.

"Well, so what if I did?" Liquor had sharpened her tongue. "That no-good son of the chief come here, after me to be telling him stories. And to make my old tongue free, he brings me the root brew. Ah, what stories I'm telling—and some of 'em true, too!" She gestured toward a crude pot. "I reckon he steals it, but what's that to us? Help yourself, Hairy One. It ain't ever' day we're getting the brew."

Hwoogh remembered the headaches of former experiments, but he smelled it curiously and the lure of the magic water caught at him. It was the very essence of youth, the fire that brought life to his legs and memories to his mind. He held it up to his mouth, gasping as the beery liquid ran down his throat. Keyoda caught it before he could finish and drained the last quart.

"Ah, it strengthens my back and puts the blood a-running hot through me again." She swayed on her feet and sputtered out the fragments of an old skin-scraping song. "Now, there you go—can't you never learn not to drink it all to once? That way, it don't last as long, and you're out before you get to feeling good."

Hwoogh staggered as the brew took hold of him, and his knees bent even farther under him. The bed came up in his face, his head was full of bees buzzing merrily, and the cave spun around him. He roared at the cave, while Keyoda laughed.

"Heh! To hear you a-yelling, a body might think you was the only Chokanga left on earth. But you ain't—no, you ain't!"

"Hwunkh?" That struck home. To the best of Hwoogh's knowledge, there were no others of his kind left on earth. He grabbed at her and missed, but she fell and rolled against him, her breath against his face.

"So? Well, it's the truth. The kid up and told me. Legoda found three of 'em, just like you, he says, up the land to the east, three springs ago. You'll have to ask him—I dunno nothing about it." She rolled over against him, grunting half-formed words, and he tried to think of this new information. But the brew was too strong for his head, and he was soon snoring beside her.

Keyoda was gone to the village when he awoke, and the sun was a spear length high on the horizon. He rummaged around for a piece of the liver, but the flavor was not as good as it had been, and his stomach protested lustily at going to work again. He leaned back until he head got control of itself, then swung down to the creek to quench a thirst devil that had seized on him in the night.

But there was something he should do, something he half remembered from last night. Hadn't Keyoda said something about others of his people? Yes, three of them, and Legoda knew. Hwoogh hesitated, remembering that he had bested Legoda the day before; the young man might resent it today. But he was filled with an overwhelming curi-

osity, and there was a strange yearning in his heart. Legoda must tell him.

Reluctantly, he went back to the cave and fished around in a hole that was a secret even from Keyoda. He drew out his treasures, fingering them reverently, and selecting the best. There were bright shells and colored pebbles, a roughly drilled necklace that had belonged to his father, a sign of completed manhood, bits of this and that with which he had intended to make himself ornaments. But the quest for knowledge was stronger than the pride of possession; he dumped them out into his fist and struck out for the village.

KEYODA was talking with the women, whining the stock formula that she had developed, and Hwoogh skirted around the camp, looking for the young artist. Finally he spotted the Talker out behind the camp, making odd motions with two sticks. He drew near cautiously, and Legoda heard him coming.

"Come near, Chokanga, and see my new magic." The young man's voice was filled with pride, and there was no threat to it. Hwoogh sighed with relief, but sidled up slowly. "Come nearer, don't fear me. Do you think I'm sorry of the gift I made? Nay, that was my own stupidity. See."

He held out the sticks and Hwoogh fingered them carefully. One was long and springy, tied end to end with a leather thong, and the other was a little spear with a tuft of feather on the blunt end. He grunted a question.

"A magic spear, Hairy One, that flies from the hand with wings, and kills beyond the reach of other spears."

Hwoogh snorted. The spear was too tiny to kill more than rodents, and the big stick had not even a point. But he watched as the young man placed the sharp stick to the tied one, and drew back on it. There was a sharp twang, and the little spear sailed out and away, burying its point in the soft bark of a tree more than two spear throws away. Hwoogh was impressed.

"Aye, Chokanga, a new magic that I learned in the south last year. There are many there who use it, and with it they can throw the point farther and better than a full-sized spear. One man may kill as much as three!"

Hwoogh grumbled; already they killed all the good game, and yet they must find new magic to increase their power. He held out his hand curiously, and Legoda gave him the long stick and another spear, showing him how it was held. Again there was a twang, and the leather thong struck at his wrist, but the weapon sailed off erratically, missing the tree by yards. Hwoogh handed it back glumly—such magic was not for his kind. His thumbs made the handling of it even more difficult.

Now, while the magic man was pleased with his superiority, was a good time to show the treasure. Hwoogh spread it out on the bare earth and gestured at Legoda, who looked down thoughtfully.

"Yes," the Talker conceded. "Some of it is good, and some would make nice trinkets for the women. What is it you want—more meat, or one of the new weapons? Your belly was filled yesterday; and with my beer, that was stolen, I think, though for that I blame you not. The boy has been punished already. And this weapon is not for you."

Hwoogh snorted, wriggled and fought for expression, while the young man stared. Little by little, his wants were made known, partly by signs, partly by the questions of the Cro-Magnon. Legoda laughed.

"So, there is a call of the kind in you, Old Man?" He pushed the treasure back to Hwoogh, except one gleaming bauble. "I would not cheat you, Chokanga, but this I take for the love I bear you, as a sign of our friendship." His grin was mocking as he stuck the valuable in a flap of his clout.

Hwoogh squatted down on his heels, and Legoda sat on a rock as he began. "There is but little to tell you, Hairy One. Three years ago I did run onto a family of your kind—a male and his mate, with one child. They ran from us, but we were near their cave, and they had to return. We harmed them not, and sometimes gave them food, letting them accompany us on the chase. But they were thin and scrawny, too lazy to hunt. When we returned next year, they were dead, and so far as I know, you are the last of your kind."

He scratched his head thoughtfully. "Your people die too easily, Chokanga; no sooner do we find them and try to help them than they cease hunting and become beggars. And then they lose interest in life, sicken and die. I think your gods must be killed off by our stronger ones."

Hwoogh grunted a half assent, and Legoda gathered up his bow and arrows, turning back toward camp. But there was a strange look on the Neanderthaler's face that did not escape the young man's eyes. Recognizing the misery in Hwoogh's expression, he laid a hand on the old man's shoulder and spoke more kindly.

"That is why I would see to your well-being, Hairy One. When you are gone, there will be no more, and my children will laugh at me and say I lie when I spin the tale of your race at the feast fire. Each time that I kill, you shall not lack for food."

He swung down the single street toward the tent of his family, and Hwoogh turned slowly back toward his cave. The assurance of food should have cheered him, but it only added to his gloom. Dully, he realized that Legoda treated him as a small child, or as one whom the sun god had touched with madness.

HWOOGH HEARD the cries and laughter of children as he rounded the hill, and for a minute he hesitated before going on. But the sense of property was well developed in him, and he leaped forward grimly. They had no business near his cave.

They were of all ages and sizes, shouting and chasing each other about in a crazy disorder. Having been forbidden to come on Hwoogh's side of the hill, and having broken the rule in a bunch, they were making the most of their revolt. Hwoogh's fire was scattered down the side of the hill into the creek, and they were busily sorting through the small store of his skins and weapons.

Hwoogh let out a savage yell and ran forward, his spear held out in jabbing position. Hearing him, they turned and jumped back from the cave entrance, clustering up into a tight group. "Go on away, Ugly Face," one yelled. "Go scare the wolves! Ugly Face, Ugly Face, waaaah!"

He dashed in among them, brandishing his spear, but they darted back on their nimble legs, slipping easily from in front of him. One of the older boys thrust out a leg and caught him, tripping him down on the rocky ground. Another dashed in madly and caught his spear away, hitting him roughly with it. From the time of the first primate, the innate cruelty of thoughtlessness had changed little in children.

Hwoogh let out a whooping bellow, scrambled up clumsily and was in among them. But they slipped nimbly out of his clutching hands. The little girls were dancing around gleefully, chanting: "Ugly Face ain't got no mother, Ugly Face ain't got no wife, waaaah on Ugly Face!" Frantically he caught at one of the boys, swung him about savagely, and tossed him on the ground, where the youth lay white and silent. Hwoogh felt a momentary glow of elation at his strength. Then somebody threw a rock.

The old Neanderthaler was tied down crudely when he swam back to consciousness, and three of the boys sat on

his chest, beating the ground with their heels in time to a victory chant. There was a dull ache in his head, and bruises were swelling on his arms and chest where they had handled him roughly. He growled savagely, heaving up, and tumbled them off, but the cords were too strong for him. As surely as if grown men had done it, he was captured.

For years they had been his enemies, ever since they had found that Hwoogh-baiting was one of the pleasant occupations that might relieve the tedium of camp life. Now that the old feud was about finished, they went at the business of subduing him with method and ingenuity.

While the girls rubbed his face with soft mud from the creek, the boys ransacked the cave and tore at his clothes. The rough bag in which he had put his valuables came away in their hands, and they paused to distribute this new wealth. Hwoogh howled madly.

But a measure of sanity was returning to them, now that the first fury of the fight was over, and Kechaka, the chief's eldest son, stared at Hwoogh doubtfully. "If the elders hear of this," he muttered unhappily, "there will be trouble. They'd not like our bothering Ugly Face."

Another grinned. "Why tell them? He isn't a man, anyway, but an animal; see the hair on his body! Toss old Ugly Face in the river, clean up his cave, and hide these treasures. Who's to know?"

There were half-hearted protests, but the thought of the beating waiting for them added weight to the idea. Kechaka nodded finally, and set them to straightening up the mess they had made. With broken branches, they eliminated the marks of their feet, leaving only the trail to the creek.

Hwoogh tossed and pitched in their arms as four of them picked him up; the bindings loosened somewhat, but not enough to free him. With some satisfaction, he noted that the boy he had caught was still retching and moaning, but that was no help to his present position. They waded relentlessly into the water, laid him on it belly down, and gave him a strong push that sent him gliding out through the rushing stream. Foaming and gasping, he fought the current, struggling against his bonds. His lungs ached for air, and the current buffeted him about; blackness was creeping up on his mind.

With a last desperate effort he tore loose the bonds and pushed up madly for the surface, gulping in air greedily. Water was unpleasant to him, but he could swim, and struck out for the bank. The children were disappearing down the trail, and were out of sight as he climbed from the water, bemoaning his lost fire that would have warmed him. He lumbered back to his cave and sank soddenly on the bed.

He, who had been a mighty warrior, bested by a snarling pack of Cro-Magnon brats! He clenched his fists savagely and growled, but there was nothing he could do. Nothing! The futility of his own effort struck down on him like a burning knife. Hwoogh was an old man, and the tears that ran from his eyes were the bitter, aching tears that only age can shed.

KEYODA returned late, cursing when she found the fire gone, but her voice softened as she spied him huddled in his bed, staring dully at the wall of the cave. Her old eyes spotted the few footprints the boys had missed, and she swore with a vigor that was almost youthful before she turned back to Hwoogh.

"Come, Hairy One, get out of that cold, wet fur!" Her hands were gentle on the straps, but Hwoogh shook her aside. "You'll be sick, lying there on them few leaves, all wet like that. Get off the fur, and I'll go back to the vil-

lage for fire. Them kids! Wait'll I tell Legoda!"

Seeing there was nothing he would let her do for him, she turned away down the trail. Hwoogh sat up to change his furs, then lay back. What was the use? He grumbled a little when Keyoda returned with fire, but refused the delicacies she had wheeled at the village, and tumbled over into a fitful sleep.

The sun was long up when he awoke to find Legoda and Keyoda fussing over him. There was an unhappy feeling in his head, and he coughed. Legoda patted his back. "Rest, Hairy One. You have the sickness devil that burns the throat and runs at the nose, but that a man can overcome. Ayeee, how the boys were whipped! I, personally, attended to that, and this morning not one is less sore than you. Before they bother you again, the moon will eat up the sun."

Keyoda pushed a stew of boiled liver and kidneys at him, but he shoved it away. Though the ache in his head had gone down, a dull weight seemed to rest on his stomach, and he could not eat. It felt as though all the boys he had fought were sitting on his chest and choking him.

Legoda drew out a small painted drum and made heavy magic for his recovery, dancing before the old man and shaking the magic gourd that drove out all sickness devils. But this was a stronger devil. Finally the young man stopped and left for the village, while Keyoda perched on a stone to watch over the sick man. Hwoogh's mind was heavy and numb, and his heart was leaden in his breast. She fanned the flies away, covering his eyes with a bit of skin, singing him some song that the mothers lulled their children with.

He slept again, stirring about in a nightmare of Talker mockery, with a fever flushing his face. But when Legoda came back at night, the magic man swore he should be well in three days. "Let him sleep and feed him. The devil will leave him soon. See, there is scarce a mark where the stone hit."

Keyoda fed him, as best she could, forcing the food that she begged at the village down his throat. She lugged water from the creek as often as he cried for it, and bathed his head and chest when he slept. But the three days came and went, and still he was not well. The fever was little higher, and the cold little worse, than he had gone through many times before. But he did not throw it off as he should have done.

Legoda came again, bringing his magic and food, but they were of little help. As the day drew to a close, he shook his head and spoke low words to Keyoda. Hwoogh came out a half stupor and listened dully.

"He tires of life, Keyoda, my father's sister." The young man shrugged. "See, he lies there not fighting. When a man will not try to live, he cannot."

"Ayyeah!" Her voice shrilled dolefully. "What man will not live if he can? Thou art foolish, Legoda."

"Nay. His people tire easily of life, O Keyoda. Why, I know not. But it takes little to make them die." Seeing that Hwoogh had heard, he drew closer to the Neanderthaler. "O Chokanga, put away your troubles, and take another bite out of life. It can still be good, if you choose. I have taken your gift as a sign of friendship, and I would kep my word. Come to my fire, and hunt no more; I will tend you as I would my father."

Hwoogh grunted. Follow the camps, eat from Legoda's hunting, be paraded as a freak and a half-man! Legoda was kind, sudden and warm in his sympathy, but the others were scornful. And if Hwoogh should die, who was to mourn him? Keyoda would go back to her people, Legoda would forget him, and not one Chokanga would be there to show them the ritual for burial.

Hwoogh's old friends had come back

to him in his dreams, visiting him and showing the hunting grounds of his youth. He had heard the grunts and grumblings of the girls of his race, and they were awaiting him. That world was still empty of the Talkers, where a man could do great things and make his own kills, without hearing the laughter of the Cro-Magnons. Hwoogh sighed softly. He was tired, too tired to care what happened.

The sun sank low, and the clouds were painted a harsh red. Keyoda was wailing somewhere, far off, and Legoda beat on his drum and muttered his magic. But life was empty, barren of pride.

The sun dropped from sight, and Hwoogh sighed again, sending his last breath out to join the ghosts of his people.

NO OTHER RACE

Anthropologists believe today that, as Lester del Rey has here portrayed, the Neanderthal man died out due to heartbreak, to an inferiority complex. One great thing differentiates men from the animals; self-realization. A man knows himself, appreciates his existence as an individual, attains to a feeling of pride and self-respect. The animals below the level of homo exist without any great degree of self-consciousness.

That is vastly important to existence of men or any intelligent race, since intelligence carries with it the necessity of self-respect. Man, as an animal, is hopeless. He can't run fast, his nose is useless for trailing, he's weak, without armored skin or clawed talons. Any animal of his bulk is more dangerous physically. But—man has intelligence! He lords it over every more powerful animal by right of cleverness.

So the Neanderthaler lorded it over the stupid beasts, made self-reliant and satisfied in self-respect by reason of his great possession—intelligence beyond all beasts.

Then true man came, the Cro-Magnon, and the Neanderthaler found himself stripped of his one possession, his one pride shown to be a tattered, foolish toy beside the immensely keener minds of true man, the one thing that gave him pre-eminence in his world shown up for the useless, wretched remnant of true intelligence.

In a decade, his self-respect was gone, his striving shown as futile worrying with clumsy toys. His crude weapons useless beside the fine-chipped, beautifully formed tools of the Cro-Magnon. The Neanderthaler sunk to a useless beggary, a beachcomber without self-respect on the fringes of the Cro-Magnon camps. Without hope, without goal for striving, the Neanderthaler ceased trying—and died.

Incredible? Senseless to attribute such feelings to them? We have on Earth today an exact and frightening duplication of that cosmic tragedy. The Bushmen of Tasmania are gone; the aboriginal race of Australia are going, become useless beggars without self-respect hanging on the fringes of the white man's civilization, unable to reach understanding of Man's higher intelligence, and paralyzed to hopelessness thereby. Those who have not contacted white men continue in their own ways, but any missionary, any government protector sent to them—brings death by hopelessness! *There is no help for them, for help is death.*

No other race can attain to intelligence while Man exists, even though Man gives every aid and help. That very effort, that contact, with a rising sub-human race means tragedy by blasting from them all hope, all self-respect.

SPECIAL FLIGHT

BY JOHN BERRYMAN

SPECIAL FLIGHT

A new author presents one of the most vividly realistic stories of space-flight science-fiction has produced.

By John Berryman

SCHWAB gravely unfastened the buckles on his corset, one by one, and finally peeled the garment off. "You know," he observed, holding it up and looking at it as though he had never seen it before, "I don't think I'd mind this job half so much if I didn't have to wear that thing. I swear it's doing something to my subconscious." Sympathetic laughter from the rest of the *Monitor's* crew ran around the crew room. Space flying had its price, and part of it was wearing "strait jackets," and heavy corsets.

Captain Feathers, a little slower about his undressing than the navigator, was still tugging idly at a zipper that refused to slide. "Agh," he breathed heavily, "it sure is good to have a trip like that one. Not a murmur out of the rockets, no detours, just a nice smooth ride in an elevator." He leaned back and stretched his shoulders.

"What's the matter, cap, getting old?" the navigator cracked.

"Not old, Schwab," he replied with a smile; "just weary."

"You'll be another Lex Cloates before you know it!" Schwab shot back at him from the shower door. "You'll be making each trip at maximum allowable acceleration just to get it over with!"

Feathers chuckled a little at the vagaries of some of the men who flew spaceships to the Moon. It wasn't an easy life. The battering of the rockets, the racking of occasional high accelerations, all tended to age a man unless he kept in the peak of physical condition. He wondered to himself whether the dream of flying passengers to the planets would ever materialize. The short haul back and forth to the Moon, ferrying the precious ores from the rich mines, was hard enough on a man. Shaking away his moody thoughts, he stood up, calling across to Buchanan, the computer, as he did: "Hey, Buck, what've you and your squaw got on for tomorrow night? How about some bridge?"

The computer paused at the shower door. "Why, I'd like to, Pete," he replied, "but I'm scheduled out at six the morning after that, I think. I can't make it very late." A chorus of denials broke out. "Everything's canceled for three days, dope," Schwab yelled from inside the shower. "The Perseids get here 6:00 a. m. tomorrow. Hines told me the last ship left over two hours ago. Everybody pulled out for the Moon."

Buchanan began to laugh. "That's a scream. First vacation I've had in six months and I forgot all about it. All right, then, Pete, tomorrow night's O. K." The showers began to hiss as the quicker ones jumped in and started the water. Feathers had just begun to struggle with his corset when the phone rang. He picked it up. "Yeah? Crew room." His face lit with concern. "What's that again? Slower, Harry." The headphone squeaked again. "Good Lord! That's terrible. Is it coming

over the ticker?" He waited an instant for an answer, and then snapped: "I'll be right up." He slapped the phone back on the pedestal again, and leaped to the shower room, where the other nine of the *Monitor's* crew were luxuriating under the needlelike jets.

"Hey!" Feathers bawled. "Hey! Shut off that water!" A few complied, and in a moment all was quiet, the men looking around shower curtains at the corset-clad captain. "Listen, men," he said, speaking rapidly. "There's been a serious accident on the Moon. Something went haywire at No. 2 Mine. Hines just phoned. I'm beating it up to his office to take a look at what comes in on the teletype from headquarters, and you men better hang around on the ready. I don't think there's another ship in the port; everybody else is up at Mines City." He ran back to his locker as a ripple of exclamations ran over the men. Most of them leaped for towels, while Feathers, who hadn't gotten wet, slipped into his captain's dungarees and dashed out of the room, tugging at the sticky zipper that exposed his bare chest.

THE dispatcher's glass-fronted office was on the ground floor of the Administration Building, and lit, at that late hour of the night, by only one green-shaded lamp on Hines' desk. The dispatcher was hunched up in his swivel chair, leaning forward, nervously reading the tape that was streaming from the teletype. His head snapped up as Feathers opened the door. "Hi, Pete," he got out in a quavering tone, "this is awful!" Feathers went to the desk.

"What's the story, Harry?" he asked. The dispatcher passed him the tape with shaking hands. His voice seemed strained, unnatural, as he replied: "All hell must have broken loose at No. 2. Bliss got a phone call through to Mines City a few minutes ago and said that maybe forty men were caught in some sort of an explosion in the smeltery. Hey! Here comes some more now!" He snatched the tape away from Feathers and leaned over to read the purple printing on the yellow ribbon.

"22,347E—06:30 AUG 10 GMT—BLISS REPORTS FROM NUMBER TWO THAT SMELTER POT APPARENTLY EXPLODED. FORTY SMELTER HANDS TRAPPED. ADVISED THAT TRACTOR WAS DUE AT NUMBER TWO AT THAT TIME FOR REGULAR PICKUP. AM MAKING INQUIRY. PLEASE ADVISE. HENDERSON."

Hines looked up. "God, that molten metal all over the place. Wonder how any got out?" Feathers' face grew stony, granitelike in the green light of the lamp shade. He lit a cigarette. The teletype began to clack again. Hines read aloud:

"22,348E—06:34 AUG 10 GMT—BLISS REPORTS TRACTOR WAS IN SMELTERY DOME AT TIME AND WAS BURIED UNDER THE MELT. OPERATOR KILLED. ADVISES FORTY-ONE DEAD NONE INJURED. INDICATES NO IMMEDIATE EMERGENCY.
"HENDERSON."

Hines' agitated face was turned to Feathers, eerie in the light as he stood up. "None injured. Those poor guys never had a prayer. What do you think happened, Pete?"

"Hell, I don't know. What do they mine there?"

"No. 2? That's tantalum, I think. Oh, that must have been frightful! That pot was filled with molten magnesium. They dissolve the tantalum out of its ores with that. When that stuff hit the air, it must have yanked every molecule of oxygen out."

Feathers walked off into the shadows of the office, out to the window that the formed the front, looking out to where the floodlighted *Monitor* stood

erect in her loading cradle. Her silvery sides gleamed, and from the gaping hole that was her after hatch, he could see the cranes unloading the pigs of metal, impure alloys about to be sent to the big refineries at Martin's Creek, the Arizona desert town that had built itself around the Earth's only spaceport. Just as the teletype began to clack again, Schwab came in, followed by Prentiss, the computer's mate. All four leaned over the machine, reading the tape as it passed out in short jerks as the operator rattled off a phrase at a time.

"22,349E—06:36 AUG 10 GMT—BLISS REPORTS EXPLOSION HURLED PART OF MELT ONTO ROOF OF TANK SHED. BOTH DOMES AT NUMBER TWO CUT OFF FROM OXYGEN. ASKS AID WITHIN TWELVE HOURS. DETAILS FOLLOWING. HENDERSON." "(EOLO.)"

Here followed a detailed account of the predicament of the remaining hundred and ten men at the No. 2 workings. In smelting the tantalum ores, through the use of molten magnesium as a solvent for the refractory metal, pressure created through boiling the magnesium had apparently burst the pot. The huge caterpillar-tread tractor used to collect the ingots of metal from the several mines that surrounded Mines City, the Moon's spaceport, had just loaded up after its call at No. 2 and was about to leave when caught in the torrent of incandescent metal. Those who were not in the mine shaft itself, or in the barracks dome, were all killed. The remaining hundred and ten, however, had been cut off from their supplies of oxygen by the explosion, which had covered the tank shed and its contents of compressed-oxygen cylinders with a great blob of the liquid metal.

The rest of the *Monitor's* crew had straggled in in the meantime, and after they had apprised themselves of the situation, the men scattered themselves around in the shadowy corners of the room, sitting on desks and filing cabinets, waiting for more news. Hines, behind his desk, showed a shiny, sweaty face in the desk lamp's cloistered glow. Cigarettes cut little red holes in the darkness of the corners, and soft murmurs of speculation stole around the office. Outside the glass front the *Monitor* was still the center of buzzing activity, as the last of her metal cargo was being swung down.

THE CLATTERING of the phone burst in on the tense silence like a bomb. Hines snatched it up. "Yes?" he quavered. He listened for a moment. "Right away, you mean?" The crew sat like statues, listening. More monosyllables from the dispatcher. With a final, "Yes, sir, right away," he hung up and swung around to the expectant group.

"That was Turner. Those guys have to have another tractor right away. He says to load that one that was scheduled to go up next week, and cart it up tonight!" Silence greeted his breathless announcement. Faces loomed whitely in the shadow as they looked from man to man.

"What ship?" Schwab finally drawled.

"Well, it'll have to be the *Monitor*. Everything else is up there. They were pulling out every couple of hours all day to beat the Perseids. Last ship left almost three hours ago."

Schwab looked slowly to his left and right, and before Feathers, who was about to say something, could speak, the navigator slowly said: "That'll be nice. The ship hasn't been serviced, injector pistons haven't been lapped, and there's a meteoroid storm in the offing. Yeah, nice trip, eh, boys?"

Feathers cut in: "You'd better get me Turner on the phone, Hines. I'd better talk to him."

The dispatcher dialed the number and

handed the instrument to the captain. "Hello," he spoke into it, "Mr. Turner? Captain Feathers speaking. . . . Yes, sir. We're the only ship in port. Just got back about an hour ago, maybe a little longer. . . . Yes, sir, we've been reading it as it came off the ticker. . . . That's what I wanted to speak to you about, sir. We're nowhere near ready to leave; we need to— . . . Oh, certainly, I understand that. I know it's their only chance, but what do you mean by right away? The ship needs some service. Those injectors—" He paused, dragging deeply on his cigarette as Turner interrupted him, his voice squeaking in the headset.

Turner finally finished. "Well, there's something in what you say, but I'd like to see a little done to them. But what's this about radio silence? . . . Don't the papers or newscasters know anything about it?" The crew sat up; that was something new. "Oh, I see. O. K., we'll do that. But there's one more thing: what about this Perseid storm?" Feathers' eyes wandered unseeing over the tense faces of his crew as they leaned forward nervously, half obscured in the dim light. "Yes, sir, I understand that, but it seems to me that it would be suicide to fly through the Perseid storm. . . . All right, I'll call them, then, and have them ring you. Thanks a lot." He hung up, but said nothing for a moment.

"Well?" Hines demanded querulously "What did he say?" Feathers snubbed his butt in an ash tray. "Turner says that tractor is absolutely the only hope those men have. They have to cart oxygen some way from Mines City to No. 2, and with the tractor up there buried in tantalum and magnesium, they can't use that. It's a good forty miles, too." He looked around the group. "Another thing, not a word of this to anybody; don't even phone your wives. They haven't let this out yet. We can't even use our radio on the way up."

"SAY, what's he handing us?" Schwab broke in. "What did he say about those meteoroids?" A chorus of assents to his question broke out. Feathers shook his head. "He said to call the Observatory and find out from them the latest possible hour of leaving. I think that guy expects us to go, no matter what they say at the Observatory. He made some crack about our having the only new detector-calculator in the whole fleet, and that that should get us through any meteoroid storm. What do you think about that, Buck?" he asked the computer.

"Hah!" Buchanan shot back, with scorn. "That machine may be pretty good at finding rocks in the sky and shoving us away from them, it may even be the best in existence, like the manual says; but it can only do five body problems, and they come in bigger batches than that at the height of the storm. Don't you think so?" he asked his mate.

Prentiss assented. "That's right, captain. After all, that is the first one they ever installed in a spaceship, and we've only had it this one trip. We aren't too familiar with it yet."

"Yeah," Buchanan began again. "Besides that, we didn't have a peep out of the detectors the whole trip, both ways. We've never even seen the darned thing work. It may be good, and fast, and then again it may be another queery. I don't know." He mumbled into incoherence, shaking his head as though affairs had gotten beyond his understanding.

"You see what I mean," Prentiss continued. "Even we don't know how well the thing works."

Buchanan interrupted him: "Oh, I imagine it works like they say, but it would have to be better than it is to get us through the Perseid storm."

Listening intently to all that was being said, Feathers had at the same time dialed a number. His connection com-

pleted, he began speaking into the mouthpiece. "Hello. I'm calling for Turner. Is it possible for a ship to leave yet tonight and beat out the Perseid storm, and if so, what's the latest safe hour of departure? . . . Well, can't you tell me that? Can't you— . . . Yes, yes," he interrupted testily, "I know all that, but this is imperative. . . . Well, get the old dope out of bed. I'm holding the wire. . . . All right, call me back, then. This is an emergency, stupid!

"Those damned astronomers!" he swore. "They're all alike. The universe is Lord knows how many billion years old, so they figure they have at least that long again to do anything!"

"What'd they say?" the navigator queried.

"Oh, some old sap answered the phone and said the chief astronomer would have to be consulted, and would I call in the morning! They'll let me know in a few minutes." He appropriated the swivel chair that Hines had left while he packed back and forth, and leaned far back. "Say," he observed, as his announcement raised no comment, "whether we can go or not, it wouldn't hurt any to have them load that tractor. That'll save a little time."

Hines waved his hand. "I forgot to tell you," he said to Feathers, "Turner already gave the order. It should be being piled in now." He bent down to peer through the window, and up. Three of the largest cranes were cooperating in loading the forty-foot vehicle into the *Monitor's* after hold. A long hose was draped out of the smaller central hatch. Feathers inquired as to the latter.

"Oh, I guess they figure that if you're going, you might as well take a load. It'll take some time to tie that tractor down in there." Schwab, who had been unusually quiet for some time, exploded at this. "Hey, what the hell? Turner acts like we're going, no matter what. Well, you boys can count me out. This whole thing sounds like a contest to see who can think up the easiest way to get killed. You boys can be heroes. I'm keeping one foot on the ground tonight."

Campbell and McCleod, Scotch engineer and engineer's mate, joined the discussion at Schwab's outburst. "Aye," yelled the engineer, "those injectors will be overmeterin' inside of an hour, and we'll all get our guts jerked out. I'm in nae mood for the ride!" The pent-up feelings of the crew broke as a babel of voices rose to condemn or approve his sentiment.

Feathers remained silent—not an extraordinary performance for him—not moving till the phone rang again. Quiet fell with a thud. "Hello," Feathers said softly. "Yes, Feathers speaking. . . . Oh, I see. Well, that's not so bad. . . . At 2:00 p. m. Greenwich mean time, August 10th. What is that by our time? . . . Uh-huh. Well, that leaves us about seven hours yet, doesn't it? . . . Will you please get in touch with Turner? . . . Thanks. Oh, one more thing: what about the Moonlets? Will there be any detours? . . . No, there's no flight forecast for tomorrow, no operations were scheduled. . . . Yes, will you phone as soon as you get that, please, for a take-off." He paused, covering the mouthpiece as he called to Hines: "When will we get off, at this rate, Harry?"

"By midnight, I guess."

"Hello. For a take-off at 12:00 midnight, mountain time, August 9th. . . . Yes, that's it." He placed the phone back on the pedestal, turning to face the crew. "It isn't so bad, men," he announced. "The Observatory says that Turner canceled operations almost a day early in order to avoid any possible meetings with the strays that usually precede the main body of the storm, and that we will easily avoid the front of the meteoroids if we get off by 6:00 a. m. tomorrow. I still think we should

scram as soon as possible."

Schwab was on his feet in an instant. "Say, listen here," he demanded ungrammatically, "we still haven't figured anything about those injectors. You know they ought to be lapped thirty-six hours after every flight. Those babies are worn from this last jaunt. We'll never get there without them being serviced. For Pete's sake, can't those boys on the Moon figure out anything?"

Feathers rubbed the stubble on his jaw and looked around the crew. "The worst of our worries is out of the way," he observed slowly. "We may have a little trouble with those injectors. I don't deny it, but for the love of Mike, Schwab, there's a hundred and ten men depending on us for their lives! This is no time to worry about a rough ride! We're going!"

SCHWAB walked up next to the desk, where the light from Hines' green-shaded lamp made him clearly visible to all. "I hate to remind you," his slow, acid tones ground out, "of what happened the last time some wise guy sent a ship out without lapping the injector pistons. Wallace and his gang are still out there, floating around, nobody knows where. I'm afraid I don't appreciate Turner's invitation to become part of the matter making up Feathers' Comet!" He stopped, staring defiantly at Feathers. The captain remained silent. "Damn it all!" Schwab cried. "Do all you guys want to be heroes? That's cheap stuff, and you know it. Listen here, Hines," he rasped, buttonholing the dispatcher, "you're the dispatcher here. Nothing can leave unless you O. K. it. What do you say? Are you going to let these saps make the score ten more at No. 2?"

Hines' pallid face peered over at Feathers, and then he croaked: "I'll check you out. It's O. K. by me."

Feathers didn't give Schwab another chance to remonstrate. "All right, men, get back into your strait jackets. Inspection in the control room in ten minutes."

Campbell stepped forward. "Cap," he began, and as Feathers nodded, said: "Those injectors won't be so bad, Schwab. We didn't cut a one out on the way in. We'll make it. I'll nurse them like a mother, I will!"

The navigator snarled incoherently.

Feathers spoke again: "Schwab, you wait here a minute. The Observatory is sending through the dope on the detours for Moonlets in a few minutes. You'll want that." The other eight started back to the crew room to strap their corsets and protectors back on, and Feathers and Schwab waited in front of the dispatcher's desk. "Hey," Feathers called after the retreating men, "I don't care how hungry you are, don't eat anything. We may have a rough trip, and I don't want any of you guys getting sick on me."

The navigator started to remonstrate once again with his chief as the three sat waiting for the call from the Observatory, but the captain cut him short. "Now listen, Schwab, I've had about enough of this. What's the matter with you? You'd think that after two years of this you'd be used to it. You've been on rough rides before. You didn't die. Now cut the chatter and get that sour look off your puss, or does it belong there?"

The reprimand seemed to make Schwab bitterer. "O. K., chief. Just as you say. The Rover Boys to the rescue. But wait till a few of those Perseids show up early. *We shouldn't be flying,* and you know it!" Then he shut up, his dour countenance growing, if that were possible, more tart. The word came at last, giving Schwab one little bit of satisfaction. None of the Moonlets would intercept the *Monitor's* course from a midnight take-off. Schwab found something to gripe about,

however. "What the hell," he complained. "No Moonlets to navigate around, what do you need me for? I'd better stay home." Feathers' scorching glance conveyed that he would stand for no more. The two stepped out the door and walked in silence across the concrete apron toward the loading dock, conscious of the clinging August heat of the desert.

Schwab glanced over to where the long launching ramp could be seen, bathed in the blue-white glare of enormous lights as it stretched its two-mile length up the slope. Then he bowed his head again, fixing his fierce gaze on the concrete apron as he swore softly to himself, not even glancing up at the towering hull of the *Monitor* as they approached it. Feathers' eyes shot up to the shiny spaceship, rising a hundred and fifty feet over his head, where its chromium-plated bulk reflected in bright, tiny points the myriads of lights that are strung around a spaceport, and mirrored in a dazzling streak the floor-lights that blazed down upon the launching ramp. Now that the after hatch had been closed, the smooth, round hull was apparently unbroken by a port or hatch for almost its entire length. The nose, however, appeared transparent, for it was here that the control-room periscopes stared out into the void. Below the quartz plates of the nose, protected by the heavy meteoroid wall, lay the control room, and beneath that, nine more decks for cargo and machinery. The stern driving rockets were hidden by the loading cradle, giving the *Monitor* the appearance of a long, thin egg held upright in an egg cup.

As they reached the loading cradle, the glowering Schwab followed the still-silent Feathers up the ladder to the *Monitor's* "back door," her lowest hatch, really an air lock, opening on I deck. They entered the lift and shot up the length of the spaceship to the control room on A deck.

II.

THE LIFT DOOR slid open and the two men stepped into the control room. Buchanan, the computer, and Prentiss, his mate, were bending over the newly installed calculator, while the rest of the crew was disposed around the room in various postures and positions. Pease, first mate, stepped from behind the chart table and handed Feathers the manifest. "Cap," he greeted him, "all's secure. They stuck in some canned goods and five hundred gallons of milk to keep cool beside the tractor." Feathers nodded silently as he signed the paper, and walked over to the calculator.

"Well, Buck," he began, "is that thing all right?"

"Sure," the computer replied. "She's a beauty. We can get five body approximations on this as easy as we got three on the old one."

Eying the complex "shuffler" from its shiny new International Business Machines label to the intricate complexity of the photo-electric sorters, Feathers cracked: "Something tells me it had better do all the Fuller brush man said it would. I'm expecting a little trouble this trip."

Schwab's explosive "Hah!" jerked Feathers' head around. "Oh, yes?" he asked. "Where's Campbell? He was here a minute ago."

"He's down checking the rockets, chief," Clement, navigator's mate, replied.

Schwab yanked himself out of his seat behind the navigator's desk and stamped toward the lift. "All I've got to say," he ground at the floor, "is that that thing better be fast, and it better be good. I just can't wait till a few Perseids pull in a little ahead of their time. They aren't so hot on arrivals and departures." He snapped a glance back at the frowning Feathers. "You know what they need, don't you, cap? A smart dispatcher

like Hines to tell them when to pull in here!" He swung the lift door open viciously as it rose from I deck, and leaned out of the cage to call, finally: "Who's taking her out, cap, firsts or seconds?"

Feathers sucked in a deep breath. "I guess I'll take her out, Schwab." He looked over to the others. "You seconds better go below for a little rest. We'll change watches every hour unless the going gets too rough." Schwab allowed the door to slam shut and the lift whined as it dropped him to the bunk room on B deck. Smiling and shaking his head, the captain dialed the engine room on the phone. "Hello, Campbell?" he finally said. "Well, what about those injectors?" His pained grin revealed that the engineer's opinion of said injectors, in spite of his optimistic sentiments in the dispatcher's office, was at extremely low ebb. When Campbell's profanity had run itself into incoherency, Feathers tried again: "Is there anything you can do with them?" Again the headset crackled as Campbell indicated his general dissatisfaction with the situation. "All right, listen, I'll be down in a couple minutes. I want to check over the service records." He hung up after a few more words. "Agh," he grunted to the ventilator screen, "I'd hate to have another ride like that one two months back."

The computer and his mate nodded their agreement. Two months previously the injectors of the *Monitor,* apparently poorly lapped in by the shop crew, had begun to overmeter, injecting excess charges of fuel into the rocket chambers. In order to prevent enormous accelerations from being achieved, four chambers eventually had to be cut out, and the majority of the flight made in a jarring madhouse.

GETTING OUT from behind the control board, Feathers asked: "How long before we get off, Buck?" Prentiss replied for his superior: "Less than an hour, now, captain." The captain walked to the lift door. As he pressed the button and waited for the cage to rise from B deck, he said: "Run through the instrument checks for me, will you, Pease? I'm taking a look around below." The lift dropped him quickly through eight decks. Campbell was not in sight as he stepped out, so, with a word to McCleod, Feathers went down the spiral stairway that led to J deck. He was still checking over the service record sheet when the squeak of Campbell's rubber-soled shoes on the steel-webbed stairs made him look up.

"Hi, skipper," the Scotchman grinned, "and what do ye find?"

Feathers smiled wanly. "Nothing, Willy," he replied. "Pretty even distribution of failures."

The engineer knelt down on the deck, and began to examine the throttle setting on the injector atop No. 1 tube, carefully entering on a slip of paper the setting. He made his way around the circle of eight heads that protruded slightly through the deck, ducking under the huge girders that all but filled the tiny space. With worries over the chance of running into a meteroid storm fairly well dispersed, Feathers, not to mention certain members of his crew, was still concerned over the fuel injectors.

Mounted atop each rocket chamber, so that they could be serviced in flight, the injectors were really tiny metering devices, Lilliputian pumps designed to force an infinitesimal, but rigidly constant, quantity of water—the fuel of the atomic rockets—into the presence of the catalyst plate with every blast of the rockets. Formed of the hardest alloys, and machined within the most microscopic tolerances, the pistons of the injector pumps still wore sufficiently with use to cause their occasional withdrawal from use. If those pistons, already partly worn from the flight in from the Moon, wore much more, the overcharged

rocket blasts would become numbing, bruising crashes, racking minds and bodies until men could no longer stand.

Campbell finally completed his check. "No. 7's throttle is cut farther back than the rest, Pete," he reported. "We may have to cut that one out pretty soon. Ah, I wish we'd run down to the shops."

Feathers raised his eyebrows. "Why so?" he asked.

And the Scotchman replied:

"Why, because they've got a photo-micrometer hitched up with an X-ray machine down there. I coulda measured those pistons without taking them out of the cylinders. Once they're out, they never go back in right." Feathers nodded, starting for the stairs, for J deck, low in the tail of the *Monitor,* was not large enough to accommodate the lift shaft in addition to the enormous girders that held the now quiescent rockets in place. Pausing at the lift door, Feathers called out to Campbell, who was still below: "That tractor tied in tight?"

"Aye, she'll not budge."

"O. K. I don't want it shifting around if we start dodging meteoroids."

PEASE was still engaged in the instrument check when Feathers stepped out of the lift again. At a touch on his shoulder he surrendered his seat behind the board, Feathers completing the job. Accumulators, carbon dioxide tanks remained to be tested, the pyrometers checked, before the captain flipped over the "Ready" light switch, its purple flashing over the board being repeated in every compartment of the spaceship. Satisfied that all was in readiness for the launching, Feathers plugged in the spaceport jack of the phone, and in a moment spoke to the dispatcher.

"Hello. Feathers reporting all set. Say, Harry, what's the number of this flight? . . . Four seventy-six, eh? Any last-minute meteoroid news?" After Hines' laconic "Nothing new, Pete," Feathers said: "Say, Harry, don't lower us into that launching cradle till the last minute, will you? I don't want to hang here by my belt and not be able to move around. Wait till 11:55. O. K.?" Hines spoke for a few seconds, to which the captain replied, "No, no, Harry. We'll pull out at 12:00 midnight. The fifteen minutes won't make that much difference. Anyway, the Observatory gave me that course for a midnight take-off at thirty-six feet per second per second acceleration, and we'd probably lose as much time detouring some of the Moonlets, if we took off early, as we'd gain by leaving then. We're lucky to miss them, I think." He reached up for the jack as Hines spoke a last few words. "Yeah, sure, we'll take it easy. This won't be hard." He hung up, and unplugging the jack, he snapped on the address system which carried his brusque syllables through the various speakers all over the ship: "First crew to stations. Take-off in twenty-two minutes."

III.

At 11:55 p. m., August 9th, the control-board phone light flashed, and Hines' voice came over the headset when Feathers picked it up. "O. K., Pete, into the cradle with you. Good luck, boy." Feathers hung the mike back on the hook and snapped on the warning gong, which filled the metal bowels of the *Monitor* with its clamor.

The huge ship began to tilt as the hydraulic jacks lowered her into the launching cradle, and came to rest at an angle of twelve degrees, the slope of the launching ramp. The tilting swivel chairs were leaned far back in an effort to keep the crew somewhere near vertical while the whole ship waited with intense expectancy through the last few minutes. Through the periscope plate could be seen the two-mile ribbing of the launching ramp, stretching out ahead of the ship, and off to the left the lights of the

never-quiet refinery town blinked solemnly, reflected almost apologetically by the stars in the cloudless sky. The twenty rails on which the cradle rested were shining ribbons that reflected the glare of the floodlights. Only the faint panting of the air purifiers testified to the fact that living beings were inside the *Monitor's* gleaming hull. As the split-second hand of the chronometer climbed up to the last minute, each man in the crew tensed himself, gathering his abdominal muscles to resist the enormous acceleration developed by the launching catapult and the ship's own rockets acting in conjunction. Just as that hand swung to vertical the cradle rumbled into motion.

A grinding noise filled the *Monitor* as she started her breathless flight up the rails of the inclined ramp. After a mile of prodigious acceleration under the actuation of the catapult, the ship's stern rockets cut in with a stuttering roar and in an instant the *Monitor* had hurled off the end of the ramp, flashed across the valley adjoining the hill from which it leaped, and quickly disappeared into the night.

Following the first quick dash up the ramp, the acceleration decreased to 36 feet per second per second, only one-eighth more than gravity. Steering rockets of gasoline and liquid oxygen flashed and turned the nose of the *Monitor* up to 60 degrees. It had long before been found impossible to use the atomic rockets for steering, since sufficient delicacy of control could not be achieved.

The spaceship climbed but slowly at first. Her departure, noticed by a newshound at the spaceport, made early editions under the caption, "Spaceship Makes Quick Turnabout," while the real reason for the hurried departure was kept from him. For the story that never made the papers, the news that never came over in a newscast, lay hidden in Campbell's worn injectors, in the well-kept secret that every spaceship had been canceled out of the ether hours before the *Monitor* leaped off the end of the launching ramp, bound through a space that was hourly expecting the arrival of a great mass of meteoric material, the August Perseids.

Slowly she drew away from Earth, her initial acceleration relative to the surface being only four feet per second per second. As the acceleration of the spaceship was maintained constant at one and one eight times gravity, it would be accelerating at the rate of 36 feet per second per second relative to the surface at the two-hundred-thousand-mile mark, where the reversal was to be made. Because of the smaller acceleration of gravity of the Moon, a similar deceleration would enable the *Monitor* to lose its velocity in the remaining fifty thousand miles. While the mean distance between Earth and its satellite is only 238,000 miles, the fact that both bodies rotate, necessitating a curved course, made the actual distance covered almost exactly 250,000 miles.

WHILE Schwab sat idly by and watched, Feathers began to place the *Monitor* on her course. The first 300 miles, through the atmosphere of Earth, always required the pilot's hands on the controls, but, once clear of disturbing forces, the ship ran herself. Since no detours were necessary—all the Moonlets being outside the optimum course—Feathers set up a simple equation on the ruled, translucent navigation panel. A tiny amber light glowed through it, and then, as he threw a second switch, a second light, white, appeared to denote the *Monitor's* course. Feathers' hands moved lightly and quickly from control to control as he attempted to stop the motion of the white light and to get it to coincide with the amber. Since he amber light was not, as was sometimes the case, moving, the task of compensating the point was simple and soon finished.

Schwab at last broke the silence. "Gee, it sure is tough to have nothing to do for once. Why don't some wise guy land on those Moonlets and blow them all to hell, then navigators could always sit around and watch the rest of you guys work."

Feathers smiled over at him. "You'd love it if we had a lot of meteoric stuff, wouldn't you, Schwabby? I think you'd be torn into little shreds by the conflict of your emotions. One side of you would be screaming, 'I told you so,' while the other was howling, "Dammit to hell.' "

The navigator laughed nastily. "There's one consolation I have, Pete. Yes, sir. That dumbbell Hines was so excited he forgot to hit me for the ten bucks I owe him. And if I don't come back, the sap is stuck for it!"

The eight rocket chambers, firing in smooth rotation, gave no trouble at the take-off. The detectors remained quiet as no meteoric material came within the range of their electro-magnetic fields. Since virtually all meteorites had been found to contain conducting materials, it had been found feasible to use magnetic detection, coupled with automatic calculating machines. These compound detector-calculators could take a series of observations on a moving conductor, compute its course and velocity, and determine whether a collision with the *Monitor* was imminent in a tenth of the time it would have taken human observers merely to ascertain the position of the body.

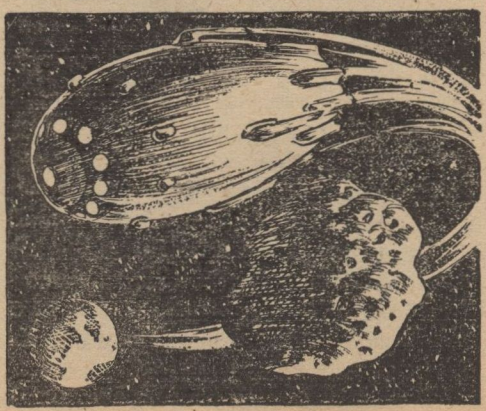
The calculator itself, built by International Business Machines, could relay its information to the autopilot in the event a collision threatened, and the latter machine could then correct the course to avoid the possible danger. The determination of the course and velocity of any single body was perfect, but when two or more conductors fell within the range of the detectors, approximations became necessary, due to the impossibility of solving the problem of three bodies. The course and velocity of as many as five bodies could be calculated in the time necessary for escape.

As the *Monitor* finally passed, with increasing velocity through the last of Earth's atmosphere, and the planet began to take on a globular appearance, Feathers noticed a slight roughness in the rockets. "Hell," he thought, "not four thousand miles out and that damned motor is cutting up already." His eyes stole over to Schwab, seated behind his navigator's desk, and then to Buchanan, who was dozing in his deep-cushioned chair.

Schwab stared back at him with a knowing leer. He nodded his head very slowly up and down. Finally he opened his mouth, drawing in a deep breath. "Well," he slowly dragged out, "you boys wanted to be heroes. Now it's coming."

Feathers shook his head and glanced at the skin pyrometers. Now that they were clear of Earth's shadow, the Sun side of the *Monitor* was beginning to heat up, in spite of the mirrorlike sheen of its chromium plating and the best insulation that men could provide.

Feathers picked up the mike. Mueller answered for the engine room. "Hello, Mueller," he said, recognizing his voice, "tell Campbell to turn her forty-five degrees every five minutes



from now on. That milk will go sour if it gets warmed up." He hung up, then jerked his head toward the board as the red detector light flashed the warning that a piece of conducting material large enough to damage the *Monitor* had come within its range. With a rattle and a whir the calculators punched and sorted the cards. But in six seconds a green light blinked the assurance that the body the detectors had located would not intercept the *Monitor's* course.

SCHWAB GLOWERED in Feathers' direction. Now that the spaceship was away from Earth, discipline was less formal than ever. "Cap," he said in a sour tone, "how'd you like to run into a few Perseids a little in advance of their time?"

Feathers seemed more cheerful than he had been all night. "How'd you like to quit grousing?" he chuckled. "Your wife will think you're a hero!"

Schwab's face got no cheerier, but he remained silent.

The phone rang. Feathers, who had left the chair at the board and was drinking at the water cooler, called: "Take it, Buck, I'm busy." Buchanan picked up the mike and slipped on the headphone.

"Yeah?" he ground into the mike. "Oh, no, not so bad up here. How does it sound down there? . . . Is that so? . . . Well, wait a minute, I'll ask Pete. Hey, cap," he called to Feathers, "Campbell says he has the throttle on No. 7 cut all the way back, but she's still overmetering. He's had to cut firing speed down four percent to keep up as at thirty-six per second."

Feathers came from the water cooler. "I'll take it. . . . Hello, Willy? What's the story? . . . No, it isn't too bad. Leave it in till I call you. Save those others."

He glanced around after he hung up, eyebrows raised in question. Schwab, still practically relieved of his duties by the absence of Moonlets, had time to grouse some more. "That chamber will be cut out in ten minutes, I'll bet you ten bucks." As though to prove his statement, the roughness increased perceptibly. As Feathers reached for the phone, it suddenly became a jarring series of smashes, and before he had dialed Campbell, the bridge crew felt the ailing chamber cut out of the circuit.

"Christmas," breathed Buchanan, "that one sure let go in a hurry. Two more seconds of that and J deck would have smacked us in the pants."

Feathers now had Campbell on the phone. "What d'ya think, Willy?" he asked. Campbell's reply was optimistic again, but Feathers, more than a little concerned with the early and sudden breakdown, asked again, "Do you think things are starting to fall apart?" A minute later he snapped the mike back on the hook and said to Schwab and Buchanan, "Campbell says that was No. 7. It was worn worse than the rest. He didn't expect it to last. I guess the others are going along better than he had hoped."

The flashing of the detector light interrupted further conversation. All eyes were on the dead green signal on the board, waiting for it to flash "safe." But after eight seconds the *Monitor* lurched as gasoline and oxygen were poured to the steering rockets by the automatic pilot. Buchanan, who had just had time to get to his chair from the chart table, but not enough to snap his safety belt, was thrown out, skidded across the rubber floor, to wind up against the ventilator opening.

He swore with vigor. The rubber floor had rubbed a good-sized piece of skin off his cheekbone. After a quick glance at the detector light, and seeing that it was now green, he hurried to the first-aid kit to repair his slightly scrambled features. Schwab, after noting the deviation from the original course which had occurred in escaping the meteoroid,

poured power into the steering rockets and corrected the course. Glancing at the return slip from the calculator, since Buchanan was still engaged in fixing the abrasion on his cheek, he remarked: "Some rock, Buck. Mass, one hundred tons; velocity, forty-six miles per second; course, sixty-four degrees from a tangent at eighty-three degrees on the Earth's surface." He looked up for a moment. "Well," he announced slowly, "that wasn't an asteroid gone wrong, anyway. A good seventy degrees from the plane of the ecliptic. What do you think, Pete; could it have been a Perseid?"

FEATHERS pursed his lips. "Let's see," he mused, "they come from Perseus, but the radiant moves about one degree a week. Where would that be now, Buck?" he asked the computer. Buchanan returned to the calculator and punched its keys for three minutes in silence. Finally he spoke. "That's about three degrees from their solar course and about six degrees from the angle at which the Perseids hit the atmosphere of Earth. And the velocity is almost exactly right. Well, I'll say it's a Perseid. After all, a few straggle through here all the time between March 20th and late in September. We just hit the central mass the 10th, 11th and 12th of August." He looked up at Feathers as he finished speaking.

The captain left the control board and walked over to the chart table. "Say, Schwab, do you think they will get any thicker? Isn't the front of that storm due in a few hours?"

The navigator snorted in disgust. He glanced over at his Manual but did not pick it up. Suddenly his head snapped erect. "Um, I don't know. Ordinarily I'd say that that rock was one of the regular ones that sail through here all summer, and that we wouldn't be likely to encounter much heavy stuff for the rest of the trip, but I just thought of something that I bet Hines and that whole flock of astronomers never figured on." He picked up the Manual, but did not open it. Still carrying the volume, he walked over to the board phone and dialed the bunk room on B deck. "Give me Clement," he said, and a minute later, "Hello, Clem. Say, do you remember the associated comet of the Perseids? . . . Yeah, well, what do they call that thing?" There was a pause, then, "Hm-m-m, that's it, I remember now. Think the dope on it will be in the Manual? . . . Yeah, well, if it isn't I'll try that, too. . . . You bet. Sleep tight."

Slinging the mike back on the hook, he faced Feathers. "Listen, Pete," he snapped, "maybe there's going to be trouble. Those Perseids seem to be associated with the unnamed comet, 1862, III, and it may be coinciding this year with the heavy section of the Perseid stream." Feathers looked at him, frowning, "What do you mean, Schwab?" he asked. The navigator stood up and moved over to the telescope mounting. As he snapped off the dust covers he spoke.

"Back in 1867, I think it was, some old bird noticed that the November Leonids revolved in an orbit identical with that of Temple's Comet. Since then quite a few comets have been associated with meteor streams. This particular one doesn't agree very well, and usually isn't listed as an associated comet." With the telescope broken out, he returned to the navigator's table and snapped several volumes out of the acceleration-proof bookholder. After several minutes, during which the detector lit up twice, only to show the green light both times, he rose again and went to the telescope. He pressed the motor contacts and swung the eyepiece. "Yeah," he grunted, "here it is." He left the telescope chair and returned to his navigator's seat.

"Pete," he said, "we may be in for

it." He swung his chair around and faced the captain. "That comet, 1862, III, has a period of a little better than one hundred and twenty-one years, and the Perseids are stretched out in a long ellipse much like the comet's orbit, and have a period of one hundred five and a half years. This comet and the Perseids are coinciding in the vicinity of the Earth for the first time in several centuries. It may seriously accentuate the showers." Schwab stared at Feathers, who stared back in silence.

"Hell, Schwab," he finally said, "I don't see what difference it'll make. That detector-calculator will solve five body problems and shove us away from bigger groups. How close do you figure the bodies will be to each other?"

Schwab leafed through the Manual. "Well," he replied, "in that famous 1833 shower they figured the bolides to be about fifteen miles apart. At our velocity that means they'd be a solid mass. I don't suppose, though, that Perseids would get that thick, but even a hundred miles between bodies is close at this speed."

Silence greeted his announcement. The detector flashed red, and then, after a few seconds' rattle from the calculator, green again. Feathers bit his lips and read the board instruments automatically through squinted eyes. He snapped a look at the chronometer. Fifty-eight minutes. That was about 7000 miles. He bowed his head, steeped in thought, then turned slowly to face the bared-toothed Schwab. "Do you think they're too thick to go through, Schwab?"

The navigator looked bitterly at him for a long time before replying. "What am I supposed to say?" he asked, at last. "You won't turn back now. Of course we can make it. This trip is a breeze for guys like us. Why, we'll never notice *those* little pebbles!" Feathers didn't press the point. What Schwab had said was true. The navigator suddenly began again. "By everything holy, that guy Hines won't get his ten bucks if I do get back! What the hell, Pete," he said, facing Feathers again, "we'll make it O. K. It's just that you strong men get me sore."

Before Feathers could speak again, a soft-toned gong announced the end of the first watch. He remained silent until Pease, the mate, Clement, navigator's mate, and Prentiss, computer's mate, filed from the lift. "Seven thousand miles out," he gritted to Pease. "The rockets are behaving too well, and Schwab says we're going to have a meteorstorm like you've never seen. See what you can do with it, Andy."

Pease grinned his reply and took Feathers' place at the board. "No trouble at all, Pete," he chuckled. "Just watch me run this boat."

Prentiss moved over to the calculator and whistled when he saw Buchanan's return slips and the notation on Schwab's navigation log. Clement, always quiet, took his navigator's place in silence.

IV.

SCARCELY had the lift door shut on the first watch and Clement gotten his belt snapped across when the detector light flared brightly and the calculator burst into furious activity. Again the green light stayed dead, while the steering rockets threw long flames to one side. For three searing seconds they jetted fiercely to port, and then gave their characteristic ending cough. Prentiss announced quietly in his reserved voice: 'Three large bodies, total mass, one hundred thirty tons, moving as a group. We apparently missed the closest by half a mile." Pease jerked erect.

"What?" he roared. "Half a mile! At this velocity we didn't have a tenth of a second to spare." He shook his head with a determined grimness. "For Pete's sake, how fast were they going, Prentiss?"

"A little better than forty-five miles a

second, the slip says," he replied, "but they were pretty well straddled, must have been a hundred and fifty miles apart. We just made the grade that time." But he smiled as he got up and walked over to the calculator. "This baby is a sweetheart," he went on. "Did you see the way it handled that approximation? Why, with that old machine, we would have breezed right through that cluster before the figures were halfway through."

Pease jabbed at the phone dial, and after a few moments spoke into the mike. "Hello, cap? Say, did you feel that jerk? . . . Yeah, that's right. Three of them this time. . . . Sure, Perseids all right. Still want to keep going, eh? . . . No, it's about 9000 so far, but we're picking up speed fast. It's 1:07 now. . . . O. K., chief." He hung up and swung back to the board, muttering to himself to the effect that the boys on the Moon sure picked one hell of a time to have an accident. "Hey, Prentiss," he said, without looking up from the controls, "can't you extend the range of those detectors a little? These swarms are too damned big to get around, and that calculator hasn't got enough sense to pick a path between more than two hunks of iron."

The computer's mate was silent for a while. Then he spoke slowly. "We might possibly swing the field of the horizontal detectors somewhat into the vertical and rig them in series with the vertical detectors. That would leave us less protected from meteoroids traveling at right angles to our course, but since our major fear is only twenty degrees from vertical, it seems to me that the chance is worth it. You'd better ask Otto or Mueller about switching those fields, though. That may be a long job."

Pease was spinning the phone dial in an instant. As he waited for the engine room to answer, he shot over his shoulder to Prentiss: "No, it doesn't take a minute. . . . Hello, Otto? Scram up here. We want you to play with the detector fields." Without waiting for a reply he slammed the mike onto the hook and spoke again to Prentiss. "Come on you probability expert, figure out how much we ought to deflect those horizontal fields to get the maximum amount of coverage, and get on the ball!"

"What do you think I am, chief?" he replied. "I have to have a great deal more data, especially some figures on the probable frequency and numbers of the Perseid bodies."

Pease scowled back at him, "Make it up, do something, you must have an idea. What does the Manual say? Can't you get some figures on the number of separate objects to expect?"

Nettled by the mate's sharpness, Prentiss answered with some heat: "Ordinarily, sir, this wouldn't be an impossible problem. We have some figures, of course, on the density of Perseid bodies at the height of the storm, but if Schwab's hypothesis is correct, we know absolutely nothing about what to expect. The presence of that comet will make a great deal of difference, I should judge."

Pease glared at him and snapped, "Say, haven't you got any brains? Just out of space school and you can't figure that out! What the hell difference does that comet make? This is the Perseid storm, isn't it?"

PRENTISS swung around to face Pease directly. "I was in hopes, sir," he said sardonically, "that I would not be forced to explain this relatively simple matter to you." He paused to let his disrespect make itself apparent, and before the smoldering Pease could find a fit retort, went on, "It is the measured opinion, sir, of Earth's most competent astronomers, that certain comets, while passing close to the Sun, have left behind them portions of their matter. Occasionally this matter follows the same

orbit as the parent comet, as in the case of the Leonids and Temple's comet. In other cases the orbits differ. When Earth, in its path around the Sun, runs into the extended pieces broken away from the comet, a meteor shower results. The Perseids, as Schwab has pointed out here, have an orbit rather similar to the comet 1862, III., but of a different period. Apparently that attenuated string of matter was broken away from the comet æons ago. Every so often the densest part of the string of Perseid matter and the 1862 comet are in conjunction at the time Earth runs into the densest part of the Perseids. This is one of the times, and we may be visited by additional amounts of matter breaking away from dear old 1862, III. I hope it is clear, sir, and also hope that you see why it is next to impossible to form any judgment on how many bodies to expect!" He spun his chair around, with his back to the astonished and slightly dampened Pease.

Checking the hot reply on his lips, the mate waved his hand and said: "O. K., O. K. I get it. But can't you do anything with that? You can make a pretty good guess, can't you?"

Prentiss, still at the board, answered, "I'm working on it now. Give me a little time and I'll have something for you."

As though to prevent a single moment's calm, the control-room crew suddenly felt the rockets go rough. For five seconds the slamming became increasingly severe as one chamber began to overmeter. In spite of the inches of sponge rubber insulation in its mounting, and the compound springs on which it was swung, the control board began to jitter. The needles on the dials began to dance, and the E deck third quadrant pyrometer snapped violently back and forth before winding up against the peg. Again before the mate could reach the phone the slamming stopped. Clement shook his head.

"Dizzy, pal?" cracked Pease, squinting his eyes anxiously in the navigator's direction.

"I'm O. K., chief," he replied, mumbling slightly. "That was some slam, though." He shook his head again. Prentiss sat tight-lipped at the calculator and resumed his work. Suddenly he sucked air between his teeth.

"That was some wallop, chief," he said. "It shook this thing up so much that the figures I put in here came out." He cleared the board and started his problem over again. As he swung his swivel chair to speak, the lift door opened and Otto stepped out.

Pease snapped him a glance over his shoulder as he started to rip the damaged pyrometer apart for repairs. "Was that you knocking at the door just then, Otto?" he gritted. The gang laughed for a second, but stilled when Otto leaned against the chart table and vomited.

"Ach," he gasped, "you should ride in that lift ven a chamber it lets go. Mein Gott, vot a bouncing you get." Pulling a bandanna from his engineer's dungarees he wiped his face, and spoke then to Pease. "Vot iss it ve are doing mit the detectors, nun?" he garbled.

"GOT it yet, Mr. Number Man?" called Pease, looking over at Prentiss.

"I have an answer," he said, "but I'd like to check the guesswork in it against your opinions. How many more groups of more than two bodies do you think we are likely to meet between now and 3:45?"

Pease answered quickly: "Why, hell, if we met three more, I'd say the sky was full of rocks. What about you, Clem?"

The navigator's mate shook his head. "I don't know. Haven't any idea," he said vaguely.

Pease and Prentiss both looked at him anxiously. "Well," said Prentiss, "I based my calculations on ten more. I know that's a lot, but I'm frankly wor-

ried by Schwab's opinion that they will be thicker than we've ever seen them."

"Hm-m-m," mused Pease. "Figuring it that way, how much should we tip those fields? Prentiss picked up the return sheet from the calculator. "On the assumption I have mentioned, and given the data in the Ephemeris about bolides approaching at right angles to our course, the maximum coverage can be obtained by tilting the horizontal fields fifty degrees. This extends our detector range twelve percent."

Pease scowled again, "What, only twelve percent?"

Prentiss, by now thoroughly out of patience, snapped back: "I was under the impression that even you would realize that the amount of power required, varies with the cube of the distance of detection."

Pease ignored his tone. "O. K., Otto," he said; "get to work on it. How long will it take?"

The German grinned. "Fife minutes und ve haff it, chief!"

No sooner had he completed the work than the detector light blinked its warning signal again. The now familiar clatter of the calculator followed, and in a few seconds, another blast from the steering rockets. This shove away from danger was the longest and most pronounced yet experienced by the crew.

Prentiss punched the calculator in silence. "Two more, chief," he said, "only twelve tons." He paused, frowned, and then said, "Wait a minute. There's something screwy here. This calculator should be able to compute us a course between any two moving bodies. We shouldn't have gone for that long ride just then."

Pease's face reflected his alarm at this announcement. "Is there anything wrong with that mowing machine?" he queried. "If that thing quits on us, we're sunk. We can wave good-by to the boys at No. 2!"

Shaking his head Prentiss replied: "I don't know. It may have been shaken up a little when that last chamber went bad. I'll run a few test problems through it." Further silence followed while the calculator rattled. "It seems O. K., chief, but these are pretty simple problems."

Pease was working the phone again. "Hello, cap," he called into it. "The calculator may be on the fritz. You better come up."

Feathers appeared in short order. After Pease explained the shift of the detector fields, which Feathers gave his nodding approval, Prentiss quietly related the partial failure of the detector calculator.

Feathers looked around the control room a moment in silence. Then he spoke slowly: "Well, I guess you've done the best you can. I imagine that the calculator was a little shaken up by that last jolt. It's probably O. K. by now. We certainly don't dare to try repairs if it is badly damaged. Nobody here is enough of a technician." With a brusque: "On your toes, gang," he took the lift back to his bunk. No sense standing there and letting the rockets slam you on the head when you could be resting. He'd need it the next hour.

THE MATE went to the water cooler, but vaulted back into his chair at the board when the detector light flashed. For eighteen agonizing seconds the bridge crew waited, each man holding his breath. With a sickening lurch the *Monitor* dashed off to one side. For eight belly-tearing seconds the quartz bull's-eye set in the port wall flared with eye-searing intensity as the steering rockets threw their fiercely driven jets to that side. Prentiss punched buttons. "One hundred and ninety-two feet per second per second for eight seconds," he read. "That's damned near a mile and a quarter. Some shove." He went back to punching his machine. "Four bodies," he spoke again, "three thousand two

hundred tons, forty-six miles per second. Miss by about one thousand two hundred feet." More punching. "At our present velocity we had exactly three one-hundredths second leeway. I'm surprised we didn't see them." The silence that greeted his calm statement was almost noisy.

Pease stared fixedly at the computer for a moment. "Are you sure that thing is O. K.? Three one-hundredths of a second is entirely too close for Mrs. Pease's little boy, entirely too close!" Prentiss nodded a silent verification of the calculator's finding. Now it was Pease's turn to begin to have doubts about the relative merits of being a live coward or a dead hero. Still, as the detector remained silent, he began to breathe more easily. The rest of the control-room crew seemed to feel with him that a chapter of the trip had come to a close, as though the escape from such a close call signaled the end of the gantlet of meteoroids they had to run. But the red light destroyed the illusion with its sudden flare. Pease swore and banged his fist down on the board as he watched for the green light that stayed dead. Another high acceleration shove brought blood from Clement's nose. He let it run while he worked furiously over the course correction controls. "Damn, I didn't even have time to correct the first blast before we scram out from under another. What is this?" he asked a little querulously.

Snapping a look at the chronometer the mate said something under his breath and reached for the phone. "Hello, cap?" he gritted into it as soon as he raised Feathers. "Listen, the way we're using steering fuel, we'll never set this thing into the landing cradle on the Moon. You know how that auto-pilot lands us, just has all the jets going half the time, swinging us back and forth. . . . Sure, that's what I think." He paused while Feathers spoke again. "O. K," he finally answered, "I'll call him right away." Instead of hanging up, he dialed the engine room. "Hello, McCleod? The chief says to disconnect the steering rockets from the rotator. . . . Yeah, that's right, quit spinning her away from the Sun, we're low on steering fuel. ... I know it, that milk will just have to go sour. . . . Yeah, yeah, O. K."

At 1:31 the detector again indicated conductors within its range. The calculator clacked for ten seconds, for fifteen, twenty. After twenty-five seconds of rattling, its noise subsided to a grinding hum. Prentiss burst into motion as he snapped one switch after the other in an attempt to clear up the trouble. As he worked, the light turned green, indicating that the Perseids had passed by. He cut the switch. Pease's voice was harsh. "Has she quit, Prentiss?" he croaked.

The computer's mate did not turn around to answer, but said, in his reserved tone: "It looks like a serious jam to me. Every operation has been suspended. I doubt whether we can repair it before we land."

HE BEGAN to strip the mechanism of its dust covers and called to Clement to break out the instrument tools. Pease remained at the board while the computer's and navigator's mates bent over the intricate entrails of the calculator. Prentiss stood up. "Do you know, we may get farther thinking about this thing than by poking into it," he said. "Let's see, the way all this trouble started was that the slamming of that overmetering chamber shook some figures out. What do you say, Clem, do you suppose that all that's wrong is the vernier settings on the selector disks?"

The navigator squinted his eyes and bowed his head in concentration. Finally he spoke. "Gosh, Prentiss, I don't know. I can't seem to get what you're driving at."

Prentiss looked back at Pease, who

returned his stare. Was Clement a little punchy-punchy from those last two rocket beatings? "O. K., Clem," Prentiss said, "never mind, I think that's it. Anyway, I'll take a look." He went back to the calculator as Clement returned to his seat, and started to reset one of the fifteen verniers.

Without any warning the calculator's clatter suddenly recommenced. The card that had been punched from the detector's data was snapped into the auto-pilot before Prentiss could do more than snatch his hand from the flailing mechanism. As he attempted to straighten up the starboard steering rockets exploded into gargantuan activity. Prentiss was smashed against the top of the calculator and bent double over it with the sudden and enormous acceleration. Clement fainted almost at once and was jammed down into his chair.

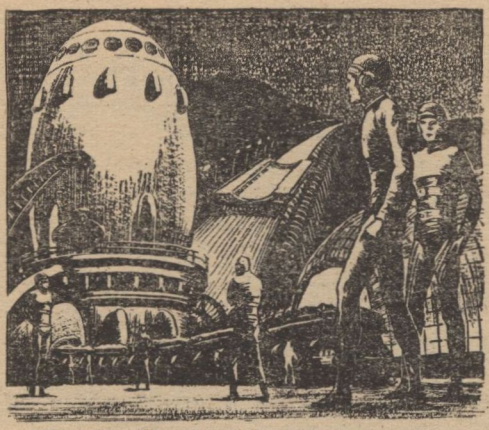
Pease, unprepared, was likewise smashed against the side of the board chair. He struggled to lift his arm against the enormous weight that seemed to press against it, and found to his horror that he could barely move it. "Eleven G" his eye recorded on the control board accelerometer, "three hundred and fifty feet per second per second." With senses reeling in his desperate effort to maintain consciousness as his chest tried to collapse and his heart almost stopped beating, he succeeded in obtaining a purchase with his legs which enabled him to pry his body forward. He strained, purple-faced, to lift his right arm with the aid of his left, to the point where he could reach the emergency cutout. As the rockets coughed their final note, his straining muscles threw him violently against his belt. Prentiss collapsed to the floor.

Ignoring the still unconscious Clement, Pease snapped off his belt and rushed to Prentiss' side. He did not appear to be seriously injured and revived in a short time. The telling solar plexus blow dealt him by the top of the calculator still made it difficult for him to talk. As Pease rose to get him some water, he noticed that Clement had revived and was standing behind him, staring wide-eyed and open-mouthed at the still recumbent Prentiss. "Hey, you!" Pease yelled at him, bringing him to his senses, "get Buchanan up here quick. On the ball!" As he was drawing the water he uttered a queer squeak: "Hey, Clem, straighten our course out. That was some push. A few more minutes riding sideways at this velocity and we'll miss the Moon completely!"

"O. K., chief," he replied, seeming to regain his composure. "How long were they burning that trip?" Pease walked to the board and read, "Eighteen seconds, and eleven G all the way. It's damned near two minnutes since I cut them out, too." An additional forty-five seconds passed as Clement worked the problem out on a slide rule and cut in the steering rockets. "In one hundred and fifty seconds, the length of time between the beginning of the blast and when I cut in the correction, we had gone just exactly two hundred miles, and we'll go thirty-seven point seven more before we stop, at three G deceleration. That's just sixty-six seconds. I think I'll set up just enough counter motion to bring us in right on the dot on the Moon. Hines' idea of an optimum course will have to be scrapped." He looked over at Pease, "Just so we get that tractor there, that's what counts, isn't it, chief?" he asked.

"Oh, yeah? Just so you get *me* there, *that's* all that counts. I'm past worrying about some other dopes' tough luck. I'll match anybody as far as being on the spot goes."

Buchanan arrived to replace Prentiss, who went below, and then Pease called the engine room. "Hi, McCleod? Did that last burst catch any of you off the ready? . . . Yeah, I know the warning didn't show. It went off by accident



while Prentiss was fiddling with the calculator. . . . That's right, the silly thing blew up right in our faces. . . . Sure, what'll you take for our chances of making it?" He laughed at McCleod's reply and slapped the mike back on the hook. Satisfied that no one had been injured below, he turned to Buchanan. "Listen, Buck," he said, "Prentiss said that the vernier settings had been deranged by the jolting of the last chamber that let go, and from what happened it looks as though he's right. Think you can do anything with it?"

V.

NO ONE SPOKE, and the detector light was miraculously dead while Buchanan examined the calculator. Finally he laid down the insulite probe in his hand, straightened up and said: "From all appearances, Prentiss had the right idea. When the rocket shook the settings out, three of the verniers on the selector disks were shifted, just how much I don't know yet, but when the machine was operating at top speed on that five body approximation, it jammed. Prentiss shut it off before any real damage was done. At least we can tinker it into sufficient shape to get us to the Moon, but we'll be nearly an hour."

Pease, who had been anxiously awaiting the verdict, grunted. "Well," he said to the floor, "an hour is better than nothing. Get to work on it. Don't anybody bother to figure out our chances of lasting out the hour, either. I don't want to know how bad things are!"

With the steering rockets out of operation, Pease unsnapped his belt and went to the calculator to help Buchanan and Clement with their work. His activities were confined mostly to handing Buchanan tools, but that was better than watching the detector blink red, and then, after a delay that aged each of them years, blink green.

The phone rang. McCleod reported that Chamber 5 was overmetering slightly, and showed inclinations of getting progressively, but not suddenly, worse. "What do you think, chief," he asked. "Should I cut it out now, while the vibration ain't so bad, and let five do the work of eight, or shall I leave it in to have the others a little?"

Pease thought fast. "Leave it in till I call you, unless it goes sour the way those others did. We'll want the smoothest ride we can get when we slap that calculator back together, so I'll call you to cut it out then." As he finished speaking the detector light flashed, but no calculator clacked into activity. The men all stopped working and waited for the green light to tell them that the conducting material had passed. After twenty breathless seconds it blinked, but only momentarily, as the ever watchful detector located another conducting body somewhere in the path of the *Monitor*. Finally the light turned green for the full five-second period. Clement collapsed to the floor as though he died with the green light.

Pease and Buchanan didn't move for an instant, and Clement regained his control. "God," he mouthed, as he struggled to his feet, "I can't stand much more of this. My nerves are shot." That was no secret. He reeled slightly

as he walked to the water cooler, spilling water as he tried to drink from the paper cup. The soft-toned watch bell interrupted him. "Ah," he breathed, "saved by the bell."

The detector light was flashing again as the first watch stepped out of the lift. Feathers glanced around and then ordered: "Buck, you better stay on this watch. Prentiss may have a broken rib. You stick around too, Clem. We'll need all the man-power we can get on this calculator. Pease, you better scram. By the way," he added, smiling, "did you have a nice trick?" As Pease glared back, Feathers laughed, "I don't guess you think that's funny!"

Pease spun around at the lift door, purple-faced. "No, I don't," he snapped. "Schwab had more sense than I realized. We were a bunch of damned fools to try this!" He started for the lift once again, then faced the solemn Feathers. "And if you think it's fun to watch that detector light, and know you can't do a damned thing about it, your sense of humor is even more distorted than I bargained for!" He slammed the door of the lift and dropped out of sight. Feathers turned to the other three.

"Well, gang," he said, "we've got a little trouble on our hands, but there's no sense letting it get us down. That tractor is going to be dumped in Mines City. It has to be. There isn't any alternative. We'll never know if one of those rocks hits us, so why worry? Say, Buck," he asked the computer, "what do you think, should we disconnect the detector light?" Buchanan frowned and turned to Schwab for an answer.

The navigator scowled and said acidly, "Hell, no, I want to know when we've got a chance to get it. I'm not going to be denied the pleasure of gloating over the ten bucks I'll never pay Hines, that dirty skunk!"

Buchanan laughed, but Clement grimaced and asked the blank wall: "Won't we ever get there? That motor is so damned rough that my brains are getting set to come out my nose!" Looking up into the stern and concerned faces of the rest of the bridge crew, he giggled, and then laughed good-naturedly. "Ho-ho, boys," he cried, "this is a breeze! Some fun, eh?"

"Easy, boy," said Feathers softly, and Clement's eyes widened as he sank into his chair. "That'd be tough," thought Feathers. "Too bad if he gets punchy. He'd better quit this racket before he gets permanently injured." Men of space, subjected as they were to the incessant pounding of rocket motors, often developed tiny bloodclots on the lining of the brain, whose pressure on delicate centers often caused them to manifest the symptoms of punch-drunkenness; mumbling speech, inability to concentrate, poor motor responses, and all the rest.

FEATHERS, Schwab and Buchanan returned to the calculator, leaving Clement sitting at his chart table. Presently Feathers straightened up for a moment to wipe the sweat from his eyes, and then paused in mid-motion as he realized that there should have been no cause for it. He stepped over to the board, where the thermometer indicated a temperature of 83 degrees in the control room. Now that the *Monitor* was no longer rotating on its axis in order to keep one side from being greatly heated by the Sun, the refrigerators were insufficient to keep the temperature down. He said nothing, but just after Schwab had phoned Campbell to cut out the rough chamber so that the final assembly could be made, Buchanan eased his aching back and said: "What's going on here? It's getting as hot as the devil." He walked to the board. "Whew," he whistled, "nearly ninety. I didn't think those refrigerators would be equal to it."

The rockets smoothed out somewhat

as the selector disks were replaced, and after the dust covers were snapped on, Schwab said to Feathers: "What do you say, cap, do I tell Campbell to cut her back in?"

"Might as well," he replied. "we'll see how it goes for a while. Try to save those other five as long as we can." Schwab called the engine room again, and the roughness recommenced, only to get rapidly worse. Feathers signaled with his hand, and Schwab, who was still holding Campbell on the phone, said: "Cut it, Willy. Skipper says it's too bad."

Feathers returned to the control board and cut in the steering rockets. He snapped across his belt and said: "Reversal in six minutes, boys, 2:51 a. m., the dispatcher said. What about it, Schwab, will Clem's new course screw that time up much?"

Schwab shook his head, "No, chief," he answered, "I just ran the problem through to see how the calculator was going, and the difference is less than a tenth of a second. Not enough to bother about."

Feathers mumbled his satisfaction and swung back to the board, laying his right hand on the stern rocket switch and watching the split-second hand as it crept up to the zero point. With his left hand he snapped on the warning gong, and at precisely 2:51 cut the stern rockets and snapped the *Monitor* smoothly end over end with the steering rockets. Again he performed the delicate task of compensation, this time to the slightly altered course necessitated by the long dash away from meteoroids when the calculator had jammed.

As Feathers concentrated his fierce gaze on the amber and white lights on the translucent-ruled panel, the detector light flashed. Without looking away from the panel, he cut the detector out, and finished the job. Schwab watched the whole procedure through narrowed eyelids. "Sweet, chief," he breathed as Feathers finished and cut the detector back in. He reached for the rocket switches and the drumming of the rockets recommenced, but with a heavy smashing that racked every man's body, pounded his brain against his skull, and turned his stomach to jelly. Feathers got Campbell on the phone.

"Cut that one out, Campbell, for Pete's sake, it's shaking the panel right out of its mounting!"

Campbell, down in the tail, spoke back, "Captain, there's only five going now. We can only cut one more, and with a whole hour yet to go, I sure hate to do it."

"Cut it anyway. Tank or no tank," he ground, referring to the tractor, "we've got to be alive to land this crock, and we'll all be jibbering idiots in a few more minutes." As Campbell continued to protest there was a dull thudding crash from below. "What was that, Willy?" shouted Feathers into the mike.

"I don't know, cap," he replied, "but it sounded a few decks above me. I'll bet that tractor is shifting! I'm going up!" Before Feathers could reply the headset clicked the announcement that Campbell had hung up. Feathers sat still as the lift whined the news that the Scotchman was ascending. It went silent almost immediately, started again, then stopped. Twice more it whined. Then the phone rang and Feathers snapped the mike off the hook.

"Yeah?" he snapped. Schwab and Buchanan regarded him tensely. "Oh, is that all?" They breathed. "Hell, no. Try to shut it off. No, wait a minute, I'll come down," he announced as the watch gong sounded 3:00 a. m. He hung up and explained as he took off the headset, "Campbell says that the supports to one milk tank on E deck cracked at the weld and dropped it to the deck. It split wide open. The tractor's sitting pretty."

PEASE, coming up for his second trick, stepped out of the lift, and some of the errant milk ran out onto the rubber floor. The mate himself was nearly covered with the white fluid. "What's happened to you?" Buchanan laughed.

The mate swore. "Somebody's up to something. I ring for the lift, and when the door slides open, it's six inches deep in this stuff, so I skid on the deck and land in it." He slipped again as he tried to cross to the board. Schwab's face brightened as he gave vent to a hearty laugh.

"Well, Andy," he chuckled, "much as I hate to have missed that little scene, I still find myself imeasurably cheered by the mental picture of you wallowing in milk. All good things come to him who waits." He laughed again as Pease stripped off his dungarees and threw them in a wet pile by the ventilator.

"Well, Andy," said Feathers from the lift cage, "at least it's hot in here, you won't catch cold." He smiled as he let the door slide shut. Buchanan and Schwab remained, since the injured Prentiss and the demoralized Clement were both unfit for their tricks.

When the lift door slid open at E deck, milk rushed into it, washing over the tops of Feathers' shoes. Campbell and Mueller stood in the middle of the third quadrant, where the lift door was, hands on hips. The Scot turned slowly to the captain and released a blistering stream of profanity, calculated to curdle the milk. Feathers replied amiably, "Hi, Willy, what are you going to do with this stuff?"

"Do with it?" Campbell squealed. "What the hell can you do with it? Even if we had an empty tank on this deck to pump it into, we don't have any pump." The lift whined away.

Mueller spoke, "Looks like the supports to the tank crystallized and cracked at the welds, sir. It might be a good idea to take a look at the other tank, too."

As Campbell sloshed over to examine the supporting brackets of the second 250-gallon tank, the lift whined again, and McCleod stepped out. "Gosh," he exclaimed, "I might have expected it of you, Willy!" Campbell's contorted features relaxed slightly.

"Is our engine room floating with this stuff?" he queried.

His mate replied, "Aye, and it ran down the stair-well, too. J deck looks beautiful from the throttle pedestal."

Mueller, who had completed the examination of the second tank's supports, straightened up. "Looks like this one is cracked, too. We'd better weld a couple of supports in here." As Campbell nodded his O. K., he left by the lift to return in a few minutes with the portable welder in its dolly and four half-inch steel rods.

McCleod reached for the rods. "Here, Mueller, I'll take 'em," he said. "Willy and I will have this done in no time."

Feathers swore with quiet vigor as he moved to the lift door preparatory to going to his bunk on B deck, sloshing through the milk, his oaths forming a soft obbligato to Campbell and McCleod, who were sulphuric in their opinions of motors that shook ships to pieces, doubly sulphuric with welds that cracked, and triply sulphuric with each other in their impatience. He shot the lift to C deck. Only food in cans here. Nothing that the milk would hurt. He opened the door and let the white liquid run out, and then rose to B deck, where he changed his dungarees and rode up again to the control room. Pease was at the board. "Hi, cap," he called, "we haven't been close to one since you've left, if you've noticed. Only three warnings. I guess we're through the worst of them." Feathers smiled and sat down next to the water cooler and sipped slowly from a paper cup.

While a peaceful quiet was slowly settling, the detector light went red, and the calculator clacked noisily, to be followed by the flash of the top rockets.

The light stayed red and the calculator did not pause as the detector located more conducting material before the first had passed. With a jerk that made necks crack, the steering rockets suddenly reversed their blasting, jamming the crew against their belts with an eight G shove. Still the light stayed red, while the *Monitor* dashed away from its course in a new direction. Pease, at the board, felt himself blacking out as the high acceleration continued past its thirtieth second. He vaguely heard Feathers yell, above the scream of the rockets, "Cut them out, Pease, cut them out!" The mate struggled to obey, finally reached the switch and the rockets died.

Schwab glowered across the control room, "What's the matter, chief, can't you take it? We'll get it sure, the sky is lousy with them!

Without replying, Feathers snapped a question at Pease. "How much fuel left, Andy?" he asked.

The mate replied, "Wow, just 53 seconds at five G!" He turned wide-eyed to Feathers. "Say, cap, you can't much more than land her with that!"

Again Feathers did not reply. "I'll take over, Andy," he said. Pease changed seats with him. Once behind the board, Feathers looked at the chronometer and read aloud: "3:12. Thirty-three minutes till the Moon cuts off those Perseids. At the rate we were using steering fuel, we never would have been able to land this crock. Might as well get hit with a rock as smash the Moon so hard that we cash in." He snapped the detector switch. The light stayed dead. "Well," he commented, "I guess we're through that swarm. If we're lucky, we'll last out."

AT 3:28 the flashing of the detector signaled the location of conducting material. The steering rockets flared within seconds, and after they cought into silence, Feathers read: "Forty-four seconds!" He glanced into the faces of the others. "One more shot is all we dare to risk. That auto-pilot needs about forty seconds at five G to land us. Any less than that and we'll drop in from wherever we run out."

Quiet fell over the control room. There was an audible sucking of breaths as the detector light flared red—then green, to the accompaniment of expelled sighs. Eight minutes before the deadline, when the Moon would cut across the path of the Perseids, it flared red again, stayed red while the calculator rattled and clattered. The port and lower rockets screamed into fiery action. Feathers, teeth bared, gripped the steering rocket switch. He watched the fuel gauge—forty seconds left, thirty-six—thirty-two. He cut the switch. The four sat immobile, waiting for the crash. The green light from the detector came like the crash of a cymbal. Feathers rasped hoarsely: "Thirty-one seconds left. I'll have to leave it off." He threw a second switch, and snapping the intense Schwab a twinkling glance, said, "Ten bucks or no ten bucks, Schwab, I'm cutting that light, too!"

"3:39," the chronometer read. Six minutes more. Feathers broke the silence. "If we last five minutes more, we have a chance. I'm going to try to get this boat close enough to the landing cradle to let the auto-pilot swing us in with only thirty seconds of fuel." Feathers squinted in thought. "Buck," he said slowly, "I want to stop this buggy as near dead as we can with the tail rockets, right over the landing cradle, and want to be approaching the cradle at an angle of two degrees. The cradle's ramp slopes at six degrees, so we want to hit the Moon at eight degrees to a tangent. Acceleration at the surface is five and a third feet per second per second. Figure out what our velocity will have to be if I can get this

crock within one hundred and fifty feet of the cradle."

While Buchanan was working the problem out, the chronometer reached 3:45, but the event was scarcely noticed, for with one danger past, the crew knew that a second, and much more apparent one, still faced them. Their chance of reaching the surface alive depended on Feathers' ability to control the *Monitor* with tail rockets instead of steering rockets, to keep it from sluing from its course as their velocity was braked with the incomplete battery of rockets. Buchanan spun his chair.

"Here it is, chief," he said. "You'll have to do twenty-seven hundred feet per second to hit the cradle at two degrees from one hundred and fifty feet."

Feathers shook his head. "That's too fast. That cradle only does seventeen-fifty. What altitude will I have to bring the crock to, to make the cradle at that angle?"

The calculator clacked.

"One hundred and eighteen feet, cap," Buchanan read tersely, recalling as he did that the auto-pilot usually took over around a thousand feet, with velocity slowed to around a thousand feet per second, a feat not so dangerous at higher altitudes.

"Guess we'll have to try it. Bring her in straight and fast, tail first, break her speed with the tail rockets, and then flip her over quick and drop her in with automatic control for the last ten seconds or so. Schwab, it's about time we scrapped Turner's radio-silence order. Get Mines City on the set. Things are too tough. If they don't put Henderson on when you indicate we're in trouble, ask for him."

WHILE Feathers broke the fall of the *Monitor* and guided her toward the desired spot on the Moon, Schwab established contact with the powerful radio station at Mines City, on the Moon's surface, and spoke into the radio mike. "May Day," he said laconically, giving the traditional English version of the international signal for aid, "M'aidez!" He was instantly connected with the superintendent of flight operations, Henderson. "Just a moment," Schwab said to him, and called to Feathers: "Here's Henderson for you, chief, and all agog." Feathers snapped the selector switch of his headset and chest microphone and spoke.

"Hello, Henderson? . . . Feathers. We're coming in in about seven minutes." He paused as the superintendent interrupted him. At last he cut in: "Hold it! We aren't down yet. Listen to me. We're about five hundred miles out yet, and decelerating at thirty-six per, but we're so damned short on steering fuel that we'll run out if we land on the radio beam, with the auto-pilot." Henderson's voice squeaked in the earphones again. "Yes, sir," Feathers responded. "The tractor's all right, chief, but I'm telling you, we're going to have our troubles getting down." He looked around at the anxious faces of the bridge crew, then began again, as Henderson's reply was brief: "Look, chief, I'll have to bring her in pretty low by myself, tail first, and use the auto-pilot for the last few seconds only. Suit you?" Curt syllables snapped in his ears. "What's the most speed you can get out of that cradle?" he asked again. "Oh, I see. Well, that means I'll have to bring this baby down to about a hundred feet before I cut you in. Tell you what. I'll make a pass at the ramp, and if we're going too fast according to the radio beam, let me know, and I'll pull her up and over and try again till I make the grade. Only got enough fuel for a couple of shots, though, and I can only give your auto-pilot about ten seconds at five G."

Henderson then spoke for some moments, while Buchanan got to work on

the calculator, converting the co-ordinates that Schwab was reading off from his position at the low-power telescope, into their course and velocity figures. Finally Feathers concluded: "You better save that, Henderson. This trick isn't over yet. Wait till we set it down. Any more news from No. 2?" Receiving a negative reply, he snapped the set off for a moment and called over to the navigator: "Henderson's laying it on thick, Schwab. You'll be a hero!" Flipping over the address-system switch, he snapped: "Tie in tight, boys; this may be a little rough!" One quick look at the schedule, a grin, and he said, half to himself: "Right on time. Hines said we'd make it at 4:07."

Schwab and Buchanan, duties completed, sat with their eyes burning toward Feathers' hands as they snapped back and forth across the board, while Pease, who was a competent pilot in his own right, went through the tortures of the damned as he had to sit and watch his superior make the approach. His hands made little jerking movements as he involuntarily tried to correct Feathers' actions. Always a ticklish task, and calling for the fastest and most accurate co-ordination, landing was, under the conditions facing Feathers, infinitely more difficult.

The surface grew amazingly close, and the *Monitor* was still traveling better than five thousand feet per second, tail first, as the whole trip following the reversal had been made. Suddenly Feathers cut in the port steering rockets for a quick blast. The *Monitor* was now heading almost parallel with the surface, still tail first, all her downward velocity killed by the blasting of the tail rockets, but possessed of a lateral velocity of nearly three thousand feet per second that Feathers had gradually built up as they had approached the surface. In another second the rockets fired roughly, slamming all down tight into their seats in a four G deceleration, and then, with that unbelievable quickness that he had, Feathers snapped the spaceship end over end. He spoke into the mike: "O. K., Henderson, here we come!"

The *Monitor* sped toward the head of the landing ramp. Feathers' headset crackled; he swore and snapped on the tail and steering rockets. Up went the nose, and the ship climbed dizzily in a hundred-mile loop, snapping over as it neared the Moon's surface again, so that the tail rockets might once more be used as a brake. Again the speed was too great for the cradle, and an instant before the *Monitor* passed the speeding Juggernaut on rails, Henderson signaled them off. Feathers grunted as he hung from his belt at the top of the huge loop. "This is it. Twelve seconds fuel to go."

The second enormous loop completed, the spaceship dashed across the surface of the Moon, perilously close to a range of low volcanic hills, its shadow leaping across the rough terrain with it. The tail rockets stuttered harshly, roughly braking the speed of the gleaming craft. Feathers abruptly flipped her over, steadied her momentarily with the steering rockets before gritting between his teeth: "Seven seconds of fuel. It's two to one against us." He switched on the automatic pilot as Henderson's voice snapped a breatheless, "O. K., Pete!" into his headset. The spaceship sagged down, almost to the cradle, under rockets flaring, before they coughed their final note. The huge craft dropped the remaining distance, wrecking half the instruments on the panel as the heavy ship bounced back and forth before the magnets of the cradle held her firm. Down the ramp the composite vehicle hurled, braking rockets throwing prodigious silent-screaming jets of incandescent gas ahead of it, and came to rest at the end of the ramp.

FIGURES waddled from the Administration Building in distended spacesuits, casting dead-black shadows on the glaring pumice, climbed into the cab of the cradle, and shunted it across switches to the hangar, a great, hemispherical dome of metal. Once inside, the enormous air lock closed; the dome lights high above came up and bathed the interior of the hemisphere with a dull pallor. Huge overhead cranes lowered their magnetic grapples, pulling the *Monitor* erect for unloading, as the increasing air pressure made the spacesuits of the docking crew go flabby. More figures aided in setting the telescopic props against the hull to hold it erect. With air pressure finally at normal, the various air locks around the dome opened, and every person who was free at the whole spaceport streamed through the openings and dashed toward the frosting spaceship.

Their shouts of welcome and praise quieted down as the lowest port of the spaceship remained closed, and the seconds passed by slowly. At last, with a shower of hoarfrost flakes, Campbell cracked the "back door," and the cheering redoubled again. The thin stream of milk that ran out and down the frost-whitened plates passed unnoticed, and the men were quickly rushed into the flight superintendent's office.

In the comparative quiet, Henderson was at last able to speak to the men, while outside the spaceport crew were rushing through the task of unloading the tractor. With the last well-wisher pushed out of the door, Henderson ran over to Feathers' side, grasped his hand, and as he shook it energetically, cried: "Oh, sweet landing, Pete! One more pass at that ramp and I'd have died of suspense!"

Feathers grinned feebly, but said nothing. The rest of the crew, now that the tension was relieved, were experiencing a like reaction. Most of them were looking around for some place to sit down, feeling generally miserable from the space beating they had taken.

The bubbling Henderson started similarly congratulating the rest of the crew, slapping one man on the back, shaking another's hand. "Is everybody O. K.?" he asked, in general.

Feathers stirred out of his lethargy. "Oh, yes. Better have a look at Prentiss," he replied. "He may have cracked a rib." He glanced around at the still-wet Pease, the soaking McCleod and Campbell, the unenthusiastic, sober faces of the crew, and then to his own wet feet. "One more casualty," he announced, so that all could hear. "Most of us got our feet wet. This space travel isn't safe. You might catch cold!"

EMPLOYMENT

By LYMAN R. LYON

EMPLOYMENT

The work was awful—in its literal sense!

By Lyman R. Lyon

R. F. D. No. 1,
Carriesville, Indiana.
August 28, 1960.

Dear George:

Thanks for your information on the State Geological Survey, and for those civil-service blanks. I've already sent them in.

If I land the job you'll probably be my boss, so you're entitled to an explanation of why I want to leave a well-paying private job and go to work for the State.

As you know, I was working for Lucifer Oil in 1957 when the depression hit, and pretty quick I was out of a job, and with a family to support. Through one of the journals I got in touch with Gil Pratt, my present employer, who was looking for an experienced geologist. You've probably heard of him—he started out in paleontology, but never worked up very high in that field because he was temperamentally unable to work under anybody. Then he took to inventing prospecting devices, and for twenty years he's been as busy as a cat on fly paper, developing and patenting his gadgets and pursuing his paleo on the side. All the money he made in prospector royalties went into paleo expeditions and into litigation. In time he accumulated outstanding collections of patents, lawsuits pertaining thereto, and fossils.

About 1956 the Linvald Fund decided he'd done such good work as to deserve a little financial elbow room, and put him on their list. He'd designed a new prospector that looked quite wonderful, but that would take time and money to reduce to practice. So those monthly checks from Oslo were welcome.

Mrs. Staples and I were sorry to leave California for Indiana, both of us being natives of San Francisco, but in our business you can't be finicky about where you work.

I worked with Platt for about six months before we were ready to try it out. I'm not revealing any secrets by saying that it works by supersonic wave charting, like the old McCann prospector. The distinctive feature is that, by using two intersecting beams, Platt gets a stereoscopic effect and can chart the major discontinuities at any distance underground that he wants.

We tried it first mounted on a truck. We would set it for, say, two yards below the surface and buzz down the road to Fort Wayne—

THE truck purred down the outside lane of the concrete at a steady fifteen miles an hour. Car after car swung to the inside lane and buzzed past, honking. Kenneth Staples, at the wheel, leaned back and shouted through the opening in the back of the cab: "Hey, Gil! Haven't we about reached the end of that strip?"

Something in the way of an affirmative floated back into the cab. Staples ran the truck off the concrete, stopped it, and went around to the rear. He

was a big, hard-looking, rather ugly man, on whom the elements had stamped a look of more than his thirty-five years. Under his stiff-brimmed engineer's hat he was very bald. He wore a hat whenever decency permitted. Men who go prematurely bald have, perhaps, a slightly greater tendency than others to select outdoor careers, or to join the army, where hats are kept on heads.

Inside the truck, a smaller, gray-haired man was bending over a machine. The top part of the machine included a long strip of graph paper carried over spools. Above the paper was poised a rank of little vertical pens. While the truck moved, these pens dropped down at intervals to make dots on the paper as it was reeled under them. The dots made irregular outlines and patterns.

Gilmore Platt said: "C'mere, Ken, and see what you think of this. I know what it is but I can't think."

Staples stared at the dots. "Looks to me like the outline of a piece out of a jigsaw puzzle."

"No. No. It isn't— I know what it is! It's a section of a skull! One of the Felidæ, probably *Felis atrox* from the size. We'll have to dig it up!"

"That squiggle? Well, maybe. You're the paleo man. But you can't go digging holes in a State highway just because there's a fossil lion buried under it."

"But, Ken, a beautiful thing like that—"

"Take it easy, Gil. This little Pleistocene overlay runs back to your place. If we run the truck around your grounds for a few hours we ought to be able to find some fossils."

"IT'S a rodent. I thought it was a bear at first from the size of the skull, but now I see those front teeth."

"Right so far. But what rodent?"

Staples frowned at the little heap of bones beside the pit. "Seems to me the only North American rodent that size was the giant beaver, *Castoroides*."

"Fine! Fine! I'll make a paleontologist out of you yet. What's this bone?"

"Scapula."

"Right. That's easy though. This one?"

"Uh . . . humerus."

"No, ulna. But you're doing pretty well. Too bad there isn't more of this one. I think we've about cleaned it out. Do you realize what this means? Hitherto we've been confined to surface indications in barren country. Now we can ignore the surface and locate all the fossils in a given area within fifteen or twenty feet of it! Only that truck won't do. We need something to carry the prospector cross country. An airplane would fly too high and too fast. I have it, a blimp!"

"Yeah?" Staples looked a trifle startled. "Seems to me like a lot to spend on applying a new device. But it's the Fund's money, not mine."

In due course Platt took delivery on the Goodyear Company's good ship Darwin. *After we learned how to fly it, we covered most of Indiana in a couple of months, and had located more fossils than we could dig up in fifty years. We made out a check list of their locations and sent copies to all the museums and universities in the country. For the rest of the summer Indiana was one big bone hunters' convention. If you took a drive into the country, the chances were that you'd pass a field in which a couple of tough-looking parties were arguing with a farmer, and you'd know that they were probably paleontologists from the Field Museum or the University of California dickering with the owner of the field for permission to dig. Though Indiana isn't a very rich State as far as fossil vertebrates go. It's mostly Paleozoic with a little Pleistocene scattered around on top.*

A FRIEND of Platt's, a Dr. Wilhelmi of Zürich, arrived for a week end. He was an archeologist and a dignified man. Staples felt a certain sympathy for him because he had even less hair than the geologist.

This Wilhelmi had been working in Anatolia, where he had found a carload of relics dating back to Tiridates the Great.

"You see, my fwiends," he explained, "they were mostly vessels and such of bwonze. Here is a picture of one as we found it. It is so corroded that it is nothing but a lump of oxide. Now, here is a picture of that one after we westored by the anode pwocess."

"Say," said Staples, "are you sure that's the same one? The thing in the second picture looks like it was just fresh out of the shop."

"Ha-ha, that is witty. Yes, it is the same. We place it in an electwolytic bath, connected to one of the poles, and wun a current thwough. So all the copper and tin atoms in the oxide cwawl back to their pwoper places. It is quite wonderful to see."

AFTER the Swiss gentleman had left, Platt went to Chicago for a consultation with his patent attorney. He returned looking thoughtful.

"Ken," he said, "let's play hooky for a few days."

Staples looked at him with a wary eye. "I suppose you mean to drop the prospector and work on your fossils for a while?"

"That's it exactly."

Thus it happened that the following day found them in the shop breaking a young *Hyracodon*—small hornless rhinoceros—out of its matrix. Staples remarked on what a dull piece the work was from a zoölogical point of view, compared to what it had been in times past.

"To some extent, yes," replied Platt. "Hand me the shellac, please. Though there may be a few whales left that haven't been turned into margarine and gun oil. We're living at the close of one of the many periodic extinctions of the larger forms. The only places you can find a fauna comparable with those of the Pleistocene is on a few preserves in Africa. And with our own blood thirsty species infesting the earth, it's getting worse all the time. Hm-m-m. The left clavicle and left radius seem to be missing." He carefully chipped slivers of sandstone away with his needle. Being much more of a talker than his assistant, he continued: "I have an idea which, if it works, may do much to relieve the drabness of our present faunæ. You heard Wilhelmi tell about restoring oxidized metal by the anode process. Well, why couldn't we work something like that on fossils?"

"You mean to grow a complete animal, hair and all, from a skeleton?"

"Why not? You know what extraordinary things they do in medicine nowadays—growing arms and legs on people who have lost their own."

"With all due respect, my dear employer, I think you're screwbox."

"We'll see about that. I'm going to try some experiments, anyway. We'll keep them to ourselves, of course. If they didn't work, a lot of our colleagues might agree with your opinion."

Platt began his work with rabbits—modern rabbits, that is. He would kill a rabbit, remove various parts, and hook it up in a Ringer's solution bath to a current source. To build up the missing parts he used bio-charged aminoacids, which will combine to form proteins and, in the presence of other cells, form whole new cells.

After many failures, he one day observed that the tissues of one of the rabbits were building up. He pointed the phenomenon out to Staples.

The geologist protested: "But it can't be that one. I turned the juice off in that tank."

"Yes?" replied Platt. "Let's see. Ah! You *thought* you turned it off, but look at this switch!"

Staples saw that he had accidentally struck the open knife switch so that the bars barely touched the contacts.

Platt said: "Now I know: we've been using too much voltage. It wants something like point oh one volts." And the little man was off like a chipmunk with a bunch of nuts, changing the rheostats to ones calibrated for higher resistance.

They perfected their method of reifying recent animals, which later proved of great value in surgery. Their results were not, however, so incredible when you consider that every cell in an animal's body contains a complete set of chromosomes with all the genes that determine the animal's form. It is as if in each cell there was a complete blueprint of the entire animal.

THEIR FIRST attempt with fossils —the fragmentary remains of the *Castoroides*—failed. Staples wasn't sorry. He was worrying about the effect of the news of this bizarre experiment on his professional reputation.

Then at dinner one night Platt jumped up and began orating. He waved his knife and fork so that he almost speared his daughter's boy friend, who slid below the edge of the table until the storm had passed. "Ken!" cried the paleontologist. "I know what to do now! You've got to have a lot of the original organic matter of which the organism was composed, in the solution along with the bones. The current makes the original atoms resume their former places, and they serve as a framework for the amino-acid molecules in their building-up work. We need a fairly complete skeleton, with considerable organic matter in the surrounding rock—if possible, with impressions of the soft parts. We'll have to analyze the rock, because if the fossil's at all old the original atoms will be so scattered through the surrounding rock as to show no visible traces."

The next day they spent in the storehouse, unwrapping the burlap from fossils and testing their matrices for organic material. They picked a specimen of *Canis dirus* embedded in a big block of sandstone, strung the block up with a chain hoist, and dumped it into one of the tanks.

Nothing happened for a long time. Then the sandstone decomposed into mud, and in its place was a blob of jelly through which they could see the skeleton. The jelly became more and more opaque, and you could see the organs forming as the original atoms took their places, and the others, from the amino-acids, polypeptides, and other substances that were introduced into the tank, lined up alongside them. It was uncannily as though the atoms had definite memories of where they belonged in the animal's body back in the Pleistocene.

When the mass in the tank stopped changing, it had the form of a huge wolf, about the size of a great Dane, but twice as muscular and ten times as mean-looking.

They fished the brute out of the tank, emptied the solution out of him, and applied an electric starter to his heart. After three hours of this, the wolf shuddered and began coughing the remainder of the Ringer's solution out of his lungs. It occurred to the experimenters that they had no place to keep the wolf, who would make a rather formidable house pet. They tethered him to a tree while they prepared a pen. But for a few days the wolf hardly moved at all. When he did, he was like a man who has been a year in the hospital, and is having to learn to walk all over again.

But at the end of two weeks he was eating of his own accord. His hair, which had been a mere fuzz at first—the process being effective in re-creat-

ing the hair roots, but not the hairs, which are dead structures—rapidly grew to normal length. At the end of three weeks he was enough his old self to snarl at Staples when the geologist entered his cage. It was a most impressive snarl, sounding rather like tearing a piece of sheet iron in two.

After that I was careful about getting too near him or turning my back on him. But he didn't give us much trouble, though he never became what you'd call friendly. I always liked him for one reason: Platt's daughter had a fluffy dog that liked to bite people's ankles—no provocation necessary. After one of my kids had been nipped, the girl and I had a real row about the excrescence. Before we could have another, the dog went out one day and yapped at the dire wolf. Mr. Wolf sprang against his bars and growled—once. That was the last we saw of that accursed pooch.

SIX MONTHS later, Platt and Staples hoisted out of its tank a specimen of *Arctotherium,* the immense bear from the California Pleistocene. Staples had had the busiest six months of his life, between helping the preparation of patent applications and getting the reification of more fossils started. There had been several failures—important parts of the skeletons missing, or insufficient organic matter in the surrounding rocks, or reasons unknown. This proved to be one of the last: the bear looked normal enough, but refused to come to life. Staples confessed that, looking at the thing's bulk, he had been more afraid of success than of failure. It was later mounted in the American Museum of Natural History, New York.

They had made things as easy as possible by starting with the *Canis,* a moderate-sized species of recent date. They worked in two directions from there: backward in time, and upward in size. Platt had a number of fossils from the Miocene of Nebraska. They were successful in reifying a *Stenomylus hitchcocki,* a small guanacolike ancestral camel. Seeking a more exciting specimen, they went to work on Platt's pride and joy, a new species of *Trilophodon,* the smallest and oldest probosidean found in America. It was probably the first member of the elephant group to arrive from Asia. The animal turned out to be a female, rather like a large shaggy tapir, with long tapering jaws and four tusks.

After their partial failure with the *Arctotherium,* they succeeded with a bear-dog, *Dinocyon gidleyi.* When Staples looked at the result his throat felt a little dry. The thing was built on the general lines of a polar bear, only bigger than even the Kodiak grizzly. Its large ears gave its head a wolfish appearance, and it had a long bushy tail. It weighed 1,978 pounds, and it didn't like anybody. Platt was delighted. "Now if I could only get an *Andrewsarchus!*" he beamed. "That's a still bigger carnivore, an Asiatic Oligocene creodont. One skull measured thirty-four inches?"

"Yeah?" said Staples, still looking at the bear-dog. "You can have him. I haven't lost him. This thing we have here is quite big enough for me."

They had hired an old circus man named Elias to help them with their growing zoo. They had built a concrete barn for the animals with a row of cages down one side. It looked strong enough, until one afternoon Staples went out to investigate a racket from the cages. He found the bars of the bear-dog's cage bowed out—the lower ends had come out of the green concrete easily—and no *Dinocyon.* Staples had a horrible vision of the bear-dog wandering over Kosciusko County and eating everything he could catch.

The beast was not, however, far away. He was, in fact, just around the

corner looking for a way to get into the *Stenomylus* cage. In a few seconds he reappeared. He looked at Staples. The geologist could have sworn that the expression in his big yellow eyes said: "Ah, dinner!" The bear-dog growled like a distant thunderstorm and started for Staples.

STAPLES knew that the animal could run circles around him on level ground, and moreover that if he caught him he wouldn't be satisfied to run circles around him. Staples' best idea was to swarm up the bars around the *Trilophodon's* inclosure. He couldn't have climbed those bars ordinarily, but he did this time.

Arrived at the top, he couldn't stay there unless he wanted the bear-dog to rear up and scoop him off his perch. On the other hand, the inside of the cage didn't look inviting. The "little" mastodon—standing five feet at the shoulder and weighing slightly over a ton—was half crazed with fear. She was gallumping around the inclosure making noises like a pig under a gate. An elephant's fear of dogs is not unreasonable when the elephant and the dog are about the same size.

Just before the bear-dog arrived, Staples jumped off and landed astride the *Trilophodon's* neck. He didn't feel like a movie hero who jumps off a balcony onto his horse. He was scared stiff. He got a good grip on his mount's scalp hair and hung on desperately, knowing that he'd be trampled to jelly in no time if she bucked him off.

Staples heard a rifle go off, several times, and got a glimpse of Gil Platt shooting out of the workshop doorway. The *Dinocyon* gave a coughing roar and went over to see about it. Staples was too busy to watch closely, but got a few glimpses of the bear-dog running around the shop, trying to climb in the windows—which were too small. He finally settled down to dig under the house. All this time Platt was popping out of doors and windows to fire and popping back again. Staples had time to reflect that the bear-dog's insides must be taking a terrible beating from the soft-nosed bullets, but that such was his vitality that you could shoot holes in him all day before he'd give up.

He made wonderful progress with his digging; he took the earth out like a bucket chain. Staples remembered that the shop had a thin wooden floor, which wouldn't offer much resistance if the animal got under the house. They needed a .50-caliber machine gun, which they didn't have.

Before it came to that, Elias climbed out on the roof and dropped a stick of dynamite alongside the bear-dog. That did the trick. The effect was rather like hitting a cantaloupe with a mallet. Staples had just gotten his animated calliope calmed down, and the explosion started her off again. It was a question of which would collapse from exhaustion first. The geologist won by a hair.

When he examined the remains of the *Dinocyon,* he asked Platt: "Why didn't you shoot him in the head?"

"But if I'd done that I'd have smashed the skull, and we mightn't have been able to reify him!"

"You mean . . . you're going to—" But Staples didn't finish. He already knew the answer. They gathered up the bear-dog, put him back together more or less the way he had been, and hoisted him into the biggest tank again. Some days later Staples was sorry to observe that the animal was making a record recovery. But Platt had a new cage built that not even this monster could break out of.

But with his size and enormous appetite, Platt decided that he was too expensive and dangerous to keep. He sold him to the Philadelphia Zoo. After the zoo people became acquainted with

him they probably regretted their bargain.

THE SALE attracted some attention, and the Philadelphia Zoo for a while had a capacity audience. Platt inquired about the market for more of his reified animals.

A couple of weeks after the sale, a sunburned man called at Platt's. He said his name was Nively, and that he represented the Marco Polo Co. This, he explained, included all the wild-animal importers and dealers in the country. It was a membership corporation instead of a stock corporation, to get around the antitrust laws.

Feeling that they could now afford some publicity, Platt and Staples showed him the place. He was duly impressed, especially with their new *Dinohyus*, a lower Miocene Elothere. It was a pig-like animal the size of a buffalo, with a mouth full of teeth like those of a bear. It ate practically anything.

Elias was assembling their biggest tank. Platt explained: "That's for Proboscidea. We haven't one big enough for them now. And out in the storehouse I've got a magnificent *Parelephas jeffersonii*. You know, the Jeffersonian mammoth. That's much bigger than the ordinary or woolly mammoth, that the cavemen made such pretty pictures of. The woolly mammoth was a rather small animal, not over nine feet high."

"That so?" said Nively. They were on their way back to the office. "My word! I thought all mammoths were huge things. I say, Dr. Platt, I have a little matter I'd like to discuss in private."

"You can go right ahead, Mr. Nively. I haven't any secrets from Staples."

"Very well. To begin, is this process of yours protected?"

"Sure it is. At least, as far as you can protect any invention by patent applications. What are you getting at, Mr. Nively?"

"I think the Marco Polo might have a proposal that would interest you, Dr. Platt."

"Well?"

"We'd like to buy up your patent applications and all rights pertaining thereto."

"What do you want them for?"

"You see, our business requires considerable capital, and involves a lot of risk. You load six giraffes on at Jibouti, and by the time you get to New York one of 'em is alive—if you're lucky. With your process we could put the animals in cold storage at the point of shipment, as it were, and—what's the word you use?—reify them in this country."

"That sounds interesting. Would you be interested in a nonexclusive license?"

"No, we want complete control. To . . . ah . . . keep up the ethical standards of the business."

"Sorry, but I'm not selling."

"Oh, come now, Dr. Platt—"

They argued some more, but Nively left without getting anywhere. A week later, just after the rock containing the mammoth had been hoisted into its tank, he was back.

"Dr. Platt," he began, "we're businessmen, and we're willing to pay a fair price—" So they went at it again, again without result.

AFTER Nively had gone, Platt said to Staples: "He must think I'm pretty obtuse! The reason they're after my process is that they're afraid it'll break their monopoly. There isn't a circus or zoo in the country that wouldn't like one or two prehistoric animals."

The taciturn Staples opined: "I have an idea they'll get really riled when we get a couple of the same species and breed 'em."

"By Jove, I never thought of that! Nobody buys wild lions nowadays. It's too easy to raise your own. That gives me another idea. Suppose we start a race of, say, elotheres, like our big piggy friend over there. And suppose civilization collapses, so that the record of our work here is lost. Won't the paleontologists of a few thousand years hence have a time figuring how the elotheres disappeared completely in the Miocene, and then reappeared again twenty million years later, warts and all?"

"That's easy," retorted Staples. "They'll invent a sunken continent in the Pacific Ocean, where the Elotheridæ hung out during the Pliocene and Pleistocene. And then a land bridge was formed, enabling them to spread over North— Hey, don't throw that! I'll be good!"

Nively's third visit was sometime later, when the mammoth was almost ready to be hoisted out of his tank. The sunburned man came to the point right away.

"Dr. Platt," he said, "we have a big business, built up with a great deal of effort, and we shan't sit around and watch it destroyed just because some scientist gets a bright idea. We'll make you a perfectly fair offer: We buy your patent application, under an agreement whereby you can practice your process, provided you name us exclusive agent for the sale of your animals. In that way you can continue your scientific work; we retain control of the commercial field; everyone's happy. What do you say, old chap?"

"I'm sorry, Mr. Nively, but I'm not in the market for such an arrangement. If you want to talk nonexclusive licenses, I might be willing to listen."

"Now look here, Dr. Platt, you'd better think twice before you turn us down. We're a powerful organization, you know, and we can make things very unpleasant for you."

"I'll take a chance on that."

"A wild-animal collection's a vulnerable piece of property, you know. Accidents—"

"Mr. Nively"—here Platt's color

wandered down the spectrum toward the red end—"will you please get to hell out of here?"

Nively got.

Platt, looking after him, mused: "There goes my temper again. Perhaps I should have stalled."

"Maybe," agreed Staples. "He wasn't actually muttering threats when he went out, but he looked as if he were thinking them."

"It's probably bluff," said Platt. "But I think I'll take on another man. We need somebody up and around all the time."

IN DUE SEASON they hoisted the mammoth out of his bath and started his heart. They were nervous, as he was by far the largest animal they had tried the process on. Platt whooped and threw his hat in the air when *Parelaphas* showed signs of life. Staples whooped, too, but he didn't throw his hat in the air.

They named the mammoth Tecumtha, after the famous Shawnee chief. He stood eleven feet six inches, which is about as big as the biggest modern African elephant. He had helically twisted tusks that almost crossed at the tips. When he became fully conscious he made some rumpus, but after a while calmed down like a modern elephant. During his recovery period he grew a thick coat of short, coarse brown hair.

Platt had, as he had said he would, taken on another man to help Elias. Early one morning Tecumtha had a slight stomach ache. This new man, Jake, went out to see what he was squealing about. Jake dissolved his medicine in an elephant highball—one bucketful, equal parts of gin and ginger extract—and took it in to him. Tecumtha was sucking it up his trunk and gurgling happily, and Jake had stepped out of sight, when Nively materialized. He walked up to the inclosure and shot Tecumtha through the upper part of his head with a Birmingham .303.

That was a mistake. The Birmingham .303 is much too light a rifle for shooting elephants. And the upper part of an elephant's head is merely a cellular bone structure to anchor its huge neck muscles. Its brain is much lower down. Nively had done all his field work in South America and didn't know that about an elephant's construction. The bullet went through Tecumtha's head, but it merely made him very, very angry. He trumpeted. That is a most startling sound the first time you hear it; like twenty men blowing bugles full of spit.

Jake heard the commotion and ran out. He took one look at Tecumtha and made for the gate. In his hurry he left it open. Nively took one more shot, which went wild. Then he ran, too, with Tecumtha after him. He had no chance to reach his car. The mammoth would have caught him right there if he hadn't spotted Elias' bicycle leaning against a tree.

The noise brought Kenneth Staples out of bed. He got to the window in time to see Nively and the bicycle whirl down the driveway with Tecumtha close behind, and disappear on the highway headed for Carriesville.

Staples did not wait to dress, but ran downstairs and out to the garage. He did pause long enough to snatch a hat from the rack in the hall. He took the truck Platt had bought for moving large animals, and started after Nively and Tecumtha.

He had not gone a mile when he was stopped by Popenoe, the local State highway cop.

"Oh," said Popenoe, "it's you, Mr. Staples. Well, what the hell do you mean by—"

"I'm looking for my mammoth," Staples told him.

"Your *what?*"

"My mammoth—you know, a big elephant with hair."

"Well, I've sure heard funny excuses in my time, but this beats anything. And in your pajamas, too. I give up. Go ahead and chase your elephant. But I'll follow you, and he better turn out to be real. You sure he wasn't pink, with green spots?"

The geologist said he was sure, and drove on to Carriesville. He found a good part of the town turned out around the public square, although nobody seemed anxious to get close.

TOWNS like Carriesville almost always have a grassy spot in their middle, and on the grassy spot either a statue or a gun and a pile of cannon balls. A typical combination is that of a Krupp 15-centimeter howitzer, Model 1916, and a pile of four-inch iron roundshot of the vintage of 1845. Carriesville had an equestrian statue of General Philip Sheridan on a tall granite pedestal in front of the courthouse. The sun was just rising, and its pink rays shone on Mr. Nively, who was perched on General Sheridan's hat. Tecumtha was shuffling around the base of the statue and trying to reach Nively with his trunk.

Staples learned later that one local citizen had emptied a pistol at Tecumtha, but the mammoth hadn't even noticed it. Then somebody shot him with a deer rifle, which annoyed him. He took after the shooter, who went away. Nobody tried any more shooting. While Tecumtha's attention was distracted, Nively started to climb down, but the mammoth returned before he had a chance to do so.

Staples drove the truck up near the courthouse and got out. Tecumtha took a few steps toward him. Staples prepared to retreat, but the mammoth recognized him and went back to Nively. He paid no attention to Staples' calls. He figured how to get his head against the pedestal without his tusks being in the way, and with one good heave, over went Little Phil Sheridan. As the statue toppled, Nively caught a branch of a big oak nearby and dangled like an oriole's nest. Tecumtha waltzed around underneath and made hostile noises.

Staples drove the truck up alongside the mammoth. He let down the tailboard, and called to Nively to swing over so he'd land on the roof of the cab, and stay there. Nively did so. Tecumtha tried to reach him there, but couldn't quite make it. He strolled around the truck. Seeing the tailboard, he ran up it into the body to get closer to Nively. Staples hoisted the tail into place and barred it. Then he went around to the front end and climbed up on the hood.

Nively was sitting on the roof of the cab, looking remarkably pale for such a sunburned man. Staples foresaw difficulties in getting back to Platt's, and he couldn't go around as he was. He thought, it's a shame to take advantage of a man who's so all in, but he has it coming to him. Aloud he said: "Lend me your pants and your money."

Nively protested. Staples was not given to lengthy arguments. He climbed up beside Nively and grabbed his arm. "Want to go over on top of your playmate?" he growled.

Nively was a hard man physically, but he winced under the geologist's grip. "You . . . your extortioner!" he sputtered. "I could have you arrested!"

"Yeah? So could I have you arrested for trespass and vandalism, not to mention stealing a bicycle. Come on, hand 'em over. I'll see that you get them back, and your car, too."

Nively looked at Tecumtha's trunk, which had crawled up over the front wall of the truck body and was feeling around hopefully, and gave in. Staples left him enough money to get back to Chicago, and he departed.

ABOUT this time Popenoe, the State policeman, and two of the town's three

local cops had gotten up their courage to approach the truck. One of the latter carried a submachine gun.

"Better get out of the way, Mr. Staples," he said. "That there's a dangerous wild animal, and we're gonna kill him."

"Oh, no, you're not," answered Staples. "He's also a valuable piece of property, and a scientifically important specimen."

"Don't make no difference. Municipal Ordinance No. 486—" He was peering under the edge of the canvas cover on the side of the truck body. He got the mammoth's location, stepped back, and raised his gun.

Staples did not see that sitting in the cab while his charge was filled with lead would serve any useful purpose. He backed the truck off the courthouse lawn and drove away. All three cops yelled. Staples couldn't go back the way he had come, because the road was blocked by cars and people. He took the opposite direction, toward Warsaw and Chicago. After two blocks he turned off and into a garage where he was known. Half a minute later he had the satisfaction of seeing two police cars shoot past the intersection with sirens going. In a few minutes they came scooting back, evidently thinking that Staples had sneaked around and made for home.

He telephoned Platt and told him what had happened. Platt said: "For God's sake, don't come back now, Ken. There's a State trooper out front waiting for you—or rather, for Tecumtha."

"Well, what'll I do? I've got to take care of him somehow. He'll be getting hungry, and he has a couple of gunshot wounds that need looking at."

Platt paused. "I'll tell you: Drive him up to Chicago and sell him to the zoo. The director's name is Traphagen. The cops won't be expecting you to go that way, and if you bring Tecumtha back here it'll just make more trouble."

As Staples hung up, the garage man asked: "Who's that Tecumtha you was talking about, Mr. Staples?" He was leaning against the truck. At that instant the mammoth gave one of his spine-chilling toots. Kennedy, the garage man, jumped a foot straight up.

"*That's* Tecumtha," said Staples pleasantly. He got into the truck and drove off.

HE REACHED Chicago about ten, and at eleven asked to see Dr. Traphagen. The director's secretary looked at Staples queerly, but then, he was a queer-looking sight, with his pajama coat, Nively's pants—six inches too short—and his bedroom slippers.

The girl asked Staples if he had a card. He got out his wallet and gave her one. When she had disappeared into the inner office, Staples remembered that it was Nively's wallet and cards that he had.

Presently she came out and ushered him in. He said: "Good morning, Dr. Traphagen."

"Mr. Staples . . . ah . . . Nively . . . ah . . . just take it easy; everything's going to be all right."

"It's all right about the card; I can explain. But my name's really Staples, and I—"

"Just what is it you want, Mr. . . . ah . . . Staples?"

"Would you be interested in buying a mammoth?"

"Well, my dear sir, we're only interested in live animals. If you have a fossil, I think the Field Museum is the place to go."

"I didn't say it was a fossil. It's very much alive; a fine adult male of *Parelephas jeffersonii*. Wouldn't you like to take a look at it?"

"Certainly, certainly, my dear sir, I

shall be glad to." Traphagen started out. As Staples walked through the door two keepers seized him. Traphagen barked at the girl: "Quick now, call the asylum, or hospital, or whatever it is!"

Staples wriggled, but the keepers had handled tougher game than a mere human being. "Listen, Dr. Traphagen," he said, "you can decide I'm a nut if you like. But I wish you'd take a look at the mammoth first. Did you ever hear of Dr. Gilmore Platt?"

"Tsk, tsk, my dear sir, first you say your name is Staples, then you produce a card with 'Nively' on it, and now you say you're Dr. Platt. Now just keep quiet. You're going to a nice place where you can play with all the mammoths you want."

Staples protested some more, but it got him nowhere. He was not a very articulate man, especially with his hat off, and he could make no headway against Traphagen's repeated injunctions to keep calm.

The ambulance arrived, and the men in white coats marched Staples out of the Administration Building and down the walk. Traphagen waddled behind. The truck was standing just in front of the ambulance. Staples yelled: *"Tecumtha!"* The mammoth hoisted his trunk and trumpeted. The horrible brassy sound so startled the internes that they let go of Staples, but to their credit they grabbed their patient again before he could take action.

Traphagen ran over and looked under the canvas. He came back crying: "Oh, dear me! Oh, dear me! I'm so sorry! I'm so sorry! Come to think of it, I do know about Platt and his process. But I never thought you were really him—I mean from him. It's all a mistake, boys, it's all a mistake. He isn't crazy, after all."

The internes released Staples. In a tone of injured dignity, he said: "I've been trying for fifteen minutes to explain who I am, Dr. Traphagen, but you wouldn't let me."

Traphagen apologized some more, and said: "Now, I don't know if you still want to discuss the sale of that animal, my dear sir, but I'd be glad to. I'll have to look at our budget first, to see what our unexpended balance for the quarter is—"

I was really more amused than angry, though I didn't let Traphagen see that until we'd agreed on the price. He was so embarrassed that he gave me a good one. A few dollars of it had to go to the Benefit Fund of the Carriesville police department, to square me with them.

Platt has hired some guards and had the place fenced properly. I don't think the Marco Polo outfit will try anything again. After all that publicity any accidents would look suspicious. Platt also hired another assistant, an enthusiastic young paleontologist named Roubideaux. They're in Wyoming now digging dinosaurs out of the Laramie Cretaceous beds.

We have some fine specimens in the cages, and more coming along in the tanks. One of the latter is a Mastodon americanus, *already promised to the Bronx Zoölogical Park in New York.*

But I started out to tell you why I wanted to leave Platt. In the first place, I'm a geologist, not a wild-animal keeper. The above gives you some idea of what working for Platt is like. In the second, I have, as I said, a family to support, and I want to keep my health. Last week I got a wire from Platt saying they'd found a complete Tyrannosaurus rex *skeleton, fifty feet long and with a mouth full of six-inch teeth. I know what that means, and I think I'd better clear out while I'm still in one piece.*

Best personal regards to you and Georgia. See you soon, I hope. Ken.

IN TIMES TO COME

Next month brings the sadly delayed Harl Vincent story, "The Morons." That was the one scheduled some time back which was delayed in the reshuffflement necessitated by the coming of *Unknown*. It is, I think, a unique story in more ways than one. Vincent has a lovely paradox—a race of moronic savages who can't make a decent bow-and-arrow weapon—but have a heat-ray apparatus of greater power than the explorers from Earth can produce!

Clifford D. Simak's story "Hermit of Mars" is illustrated on the cover—another by Graves Gladney—and an unusually realistic yarn.

Nat Schachner has a "rescue from the future" type story that is definitely atypical. It's a perfectly logical idea, but one that hasn't, so far as I remember, been pointed out before.

And our two serials conclude next month. Two—because of Sprague de Camp's genuinely important and close-reasoned article on life, and the engineering of life-forms. Incidentally, we herewith challenge any reader or readers to think up a method of locomotion that hasn't been tried by some form of life here on Earth that is possible to life's necessities. (That is, propellors don't go, because you can't design a blood-system that would be practicably simple.) If life has missed any methods that would be worth trying, we'd like to hear about it. They've even used the rocket principle!

THE EDITOR.

THE ANALYTICAL LABORATORY

The scores this month were unusually close: "Problem in Murder" leads "Children of the 'Betsy B.'" by one point only, with "Star Crash" only two points behind, and "Cosmic Engineers" but one point behind that. From second place to fifth place, in fact, was a range of only four points! But the places ran as follows:

1. Cloak of Aesir, Don A. Stuart.
2. Problem in Murder, H. L. Gold.
3. Children of the "Betsy B," Malcolm Jameson.
4. Star Crash, Kent Casey.
5. Cosmic Engineers, Clifford D. Simak.

MELODY AND MOONS

BY KENT CASEY

MELODY AND MOONS

"Heigh ho! Heigh ho!" takes on meaning when presented by Private Kelton!

By Kent Casey

THE small resort city of Marsopolis had so far been exempt from the bombardment of Uranian raiders. The mine fields and ore-reduction plants of the Interplanetary Co. of Terra had been the first points of attack when the war had started unheralded two years before; but Marsopolis, of no particular commercial or strategic value, had been left alone. Built as a vacation town for the pleasure-starved workers and engineers in the mines, it now kept up a brave but frightened front. Its cabarets still blazed with lights and its orchestra and singing girls "carried on" for the benefit of the half ruined colony of Earthmen who remained.

Ships came by, relief ships taking out refugees and leaving provisions for those who remained, harried freighters escaping from the ravaged trade lanes stopped for water and fuel; and ships of the fleet sometimes had brief leisure to give liberty there, for Mars was at that time Earth's farthest advanced base. Marsopolis carried on, doing its bit to make the lives of the hard-pressed sky fighters less monotonous.

The *Beagle*, recently completed and manned, had finished her first tour of duty scounting the lanes and had come into Marsopolis for fuel and minor repairs. A score of her crew had been sitting around tables in the Palace Café, their strained faces relaxing a little after a good dinner and a few bottles of wine.

"They're a cagy lot, those Uranians," said Private Mellor. "They seem to know exactly where every ship of our fleet is all the time. If we're cruising singly, they concentrate four or five ships and raid. If we go out in squadron, there's never a Urie ship to be found except away to heck and gone from where we are, raiding where we aren't. They must have mighty good detectors."

Master Electrician Andrus shook his grizzled head. "They've got good detectors, maybe a bit better than ours, but that don't account for it. Their beams on the interceptors don't show any more power than we use. Nope, it isn't that they're so much better than we are. They've got a fixed base somewhere not too far from our lanes. On land somewhere so they can have room for mighty big aërials and can use tubes too sensitive to take the mauling shipboard use would give. The base is doing the spy work and slipping the news to the fleet."

"Why don't you locate it with the compass, then?" asked Private Kelton, hiccupping slightly.

"Huh!" grunted Andrus. "Ever hear of an Armbruster Scrambler? Radio compasses are no good in this war—nobody's using the old Hertzian waves nowadays. The only way to get a clear directional finding is with a spy beam."

"B-but where could they have a base we don't know about?" Kelton continued, shaking his fuddled head slightly.

"Where? Lots of places! Might be somewhere on Mars, for that matter.

We haven't got it all surveyed—let alone occupied it. Then there's a lot of big asteroids. Might even be on our Moon. A listening station needn't be very big, and it would be hard to see without a detailed search. Just a flat, solid building and long aërials and a fair-sized power plant. But say, Kelton, you better quit drinking. You know you can't stand very much. You look kind of lit now. Want to go back to the ship?"

Kelton stiffened in tipsy dignity. "Go back? No, sir! Not me. I'm perfeckly sober, I am. What I want to go back for?"

"O. K., but watch your step. The general recall siren's likely to go off any time."

KELTON drew back offended. To cover his embarrassment and prove his complete sobriety, he began to hum to himself. Gradually a rollicking little tune grew out of his aimless quavers. As he perfected the melody, his hands were held stiffly in front of him. The fingers of his left hand pressed phantom banjo frets and his right hand plucked make-believe strings.

"Hm-m-m! Oh, oh, oh!
Cruisin' through the Pleiades all alone!
Hm-m-m! Oh, oh, oh!
Orion's playin' his saxophone!"

"What's that song? It's right pretty," Andrus demanded.

Kelton blinked a little and suppressed a hiccough. "I made it," he announced proudly. "'Sa good tune. I haven't got the words right yet. It's going to be dedicated to you, Pop. This little ballad, ladeeze and gennlemen, is entitled, 'The Curse of Drink,' or 'I Wish I Had a Barrel of It.'"

"Don't you drink any more, kid. You're soused to the eyes now. We'll start back to the ship pretty soon."

"Humph!" grunted Kelton indignantly. He continued to plan a stringed accompaniment, twisting his fingers clumsily, humming the tune over and over to fix it in his memory. Mellor left the table to dance with one of the cabaret girls. Old Andrus, spying a friend in a crowd of prospectors who had just come in, crossed the room to speak to him. Kelton was left alone at his table, singing softly and beating time. The orchestra blared into a syncopated melody, making it difficult for Kelton to hold his own tune.

He gulped the wine remaining in his glass. "The air in here is gettin' dog-gone close," he muttered to himself. Unsteadily, Kelton got to his feet, took good aim at the door and marched toward it, his eyes slightly glazed and his feet uncertain. Mellor, dancing by, called out. "What's the matter, Kel? Going back to the ship?"

Kelton grunted. His answer might have been "Yeah," but was too indistinct for Mellor to catch.

"Want any help?" Mellor called over his shoulder.

"Huh-uh. No, thank you. I'm perfeckly all right," said Kelton, and lurched out of the doorway. He wandered off the path into the shrubbery. The chill air of the night set the wine whirling in his head, and the sudden darkness struck his eyes like wool. Kelton half slumped to the ground. "Dog-gone! Mus' be an earthquake," he mumbled. Then he tumbled over on his side and lay still. The ground still heaved, but not so badly as it did. "Cruisin' through the Pleiades all alone!" he hummed sleepily. "'Sa good tune but I gotta get words. Gotta fix that—"

His number ears heard a shrill, rhythmic scream: long—short, short; long—short, short! "Gen-ral recall, by golly; Cap'm Carroll wan's all hands back aboard. 'Stoo bad." He tried to rise, but just then heard a pounding of feet as the patrolmen, summoned by the

siren, ran out and started for the airport. He heard Andrus shouting, "Where's Kelton?" and Mellor's reply, "He started back to the ship about half an hour ago."

Kelton sank back with a giggle. "Fool 'em. They think I'm already there. Won' they be surprised." He rolled over on his back. His mouth opened and his eyes closed.

Private Kelton went to sleep, and not even the shouts of the shore patrol hastily searching for him, nor the roar of the *Beagle's* rockets at her departure an hour later wakened him. Private Kelton was over leave, missing his ship; and the notation on his record contained the ominous added clause: "The planetary government then being in a state of war."

HE AWOKE in bright sunshine, chilled to the bone and with pounding head. Confused noises rang in his ears. "Ouch! What a brannigan I must have had last night!" he moaned as he started to rise. The shook his head vigorously in an attempt to clear it, whimpering a little under his breath with the pain. The noise did not subside. There was confused trampling of feet and a babel of voices. Somewhere a woman was screaming in hysterical protest. "Huh! What goes on?"

Waveringly, Kelton scrambled to his feet and stared. A milling crowd of prospectors, waiters and singsong girls were herded into the street, many objecting shrilly. A crowd of uniformed men with tremendous shoulders and stocky legs were guarding them while others systematically looted the shops and restaurants. Half a dozen great ships were hanging menacingly aloft; and on the nose of each the appalled Kelton could make out a crimson mark like a grinning skull. "Uranians, by golly! I got to get back to the ship!"

He started forward out of the shrubbery, then stopped, terrified. The ship was gone! "She was to sail at midnight! I'm sunk!"

He tried to shrink back behind the thick bushes; but a dry voice barked behind him, speaking interplanetary pidgin with an odd, thin accent.

"Stick 'em up, patrolman! What are you doing here?"

Kelton whirled about, throwing his hands in the air as he did so, and found himself confronting any enemy officer. He had a first, wild idea of trying to tackle the man and escape, but the powerful, stocky frame of the raider looked even more dangerous than did the force pistol in his hand. Kelton gulped.

"Where's your ship?" snapped the Uranian.

"She sailed last night," Kelton said.

"So? Then what are you doing here?"

Kelton glanced ruefully at his rumpled uniform, covered with dust and dry leaves, and felt for his missing helmet. "Look at me," he replied simply. "I got too much to drink last night and missed her."

"Oh!" sneered his captor. "That's bad! Drunk and A. O. L. in wartime, eh? Sure you're not deserting?"

Kelton stiffened and flushed angrily. "I'm no deserter!" he growled. "I'm—" his voice trailed off uncomfortably. He would have a hard time convincing a court that he wasn't a deserter, at that!

"I guess I'm just a damned fool," he ended miserably.

"What's your rating?" suddenly asked the Uranian.

It was on the tip of Kelton's tongue to reply truthfully "electrical machinist," but it flashed into his mind that the Uranians were said to force prisoners to work in their shops. Perhaps economy of the truth might be thrifty. "I h-haven't been rated yet," he stammered. "I've been helping the cooks."

"Hm-m-m! Well, come along. We're not leaving you here to give any information to your fleet. No more of this war for you, buddy! Forward march—and keep those hands up!"

The raiders had finished their work of demolition.

They left the water supply untouched and had burned nothing; but the fuel tanks were destroyed and everything of value had been filched from the little city. Commandeered trucks and carts carried their plunder to the landing field. Ship after ship swung low to receive it and take aboard her landing party. Kelton's captor herded him aboard the last ship to depart. Kelton was pleased to hear the report made of his capture.

"He's not a technician," the officer stated. "Just a galley striker. We can, maybe, made a mess attendant of him somewhere."

TURNED OVER to a scowling petty officer, Kelton was shoved unceremoniously below, his uniform taken from him and a suit of dungarees given him in its place. His guard tossed him a meager roll of bedding and then locked him into a small cell in the brig. The Uranian began to wrench the buttons and collar ornaments from the captured tunic.

"Make nice souvenirs to take to my girl," he said. "You won't be needing them any more, mister."

Kelton dropped miserably onto the cot in his cell. His head was throbbing horribly and his throat was like a grater. Oh, what a fool he had been! His aching muscles slowly relaxed and he realized that the cot, built to hold the great bulk of the Uranians, was wider and softer than his regulation mattress on the *Beagle*. He lay back, trying not to groan aloud, and again slipped into an exhausted sleep.

The universe was a little brighter after he had rested. The petty officer had waked him with a grunt of: "Rise and shine, patrolman! You're going to hit the land pretty soon." At the galley he had been given a bowl of thick soup and a chunk of bread. A passing sergeant, noticing that he was wearing only the dungarees given him that morning had called out, "Hey, somebody, get this prisoner a pea-coat. He'll freeze when we land him." Kelton wished that he could shave and get his own uniform back; but his head was clear, and the hot soup had warmed and livened his jaded body.

He tried not to think about being a prisoner until the war was over. He tried to forget that with an A. O. L. on his record—and that not the first one—there would be little effort to exchange him. The Terran ships had not captured very many Uranians so far anyhow, and an exchange was a very remote possibility indeed. Kelton shrugged his shoulders.

"'However, comman—'" he quoted, philosophically. "'Cross that bridge when I get to it.' Wonder where I'm being put down?" In the meantime, these Uries seemed not to be such a bad lot. They had even returned his cigarettes.

An hour later, the petty officer again opened the door of Kelton's cell. "Come on, prisoner. You're going to work."

Through the ports by the gangway, Kelton caught glimpses of his destination. "One of Jupiter's moons, I see. Which one is it?" he asked.

"Ask no questions and keep out of trouble!" barked the Uranian.

The ship turned and twisted for a landing, circling the satellite at decreasing speed. Kelton racked his brain trying to remember the names of Jupiter's four major moons. Europa was one, and—er—Ganymede? And—Cal-something. The fourth? The name had completely left his memory. But why a moon of Jupiter?—he wondered. Why were they not taking him to Uranus?

THIS QUESTION did not remain long unanswered. The officer, who had first taken him at Marsopolis, came up the ladder.

"You are being landed here," he said shortly. "The gravity on this small planet should enable you to be useful, and the station here is short of mess attendants. If we took you to Uranus, you would have to wear a nullifier and you couldn't do much work. Your treatment here will depend upon how well you do your assigned duties."

"Yes, sir," Kelton answered briefly. Inwardly he was thinking that it was a good thing he had lied about his rating. Working in the kitchen wouldn't be so bad and the chances for getting enough to eat were better there. Besides, he would naturally have refused to do any machine work that might be used against his own people and likely would have spent the next several years in a cell on scant rations.

The ship maneuvered queerly as she approached the ground, flying at a precariously low altitude apparently straight for the side of a snowcapped mountain. With her repellers holding her only a few yards above the treetops and her speed cut to a crawl, she drifted through the dusky night. When the mountainside looked fearsomely close, she made a quick, right-angled turn and entered a narrow valley. A few more minutes found her settling gently on a tiny field at the foot of a high, noisy waterfall. Kelton was hustled from the ship into a large, squat stone building with tightly shuttered windows. No speck of light showed from the outside, making the building invisible a very short distance away.

Inside, however, it was warm and bright. Kelton was turned over to the officer in charge and passed along to the steward, who looked him over quizzically.

"Don't they grow 'em any bigger than you on Earth?" chuckled the steward. "But maybe you're handy. Here's your quarters. Soon as you're washed up report in the galley. Right down this corridor, third door. It's almost supper time. You've got no kit?" He turned to a dungareed man passing by. "Greco, jump down to the canteen and get a razor and some soap for the new prisoner. He'll be getting his whiskers caught in the hash, if we don't let him shave."

Kelton found himself charged with waiting table at the technicians' mess which, to his delight, was not a particularly onerous task nor one which called for much training. He set the platters of food on the table, kept the water pitchers and coffee urns full, and cleared away after the meal was over. Lazy as he was, Kelton had the spaceman's curious neatness; and his very indolence made him perform necessary tasks rapidly.

The steward watched him with growing satisfaction. "Keep that up and you'll do, young fella," he said approvingly. "You can go to bed when you get those dishes done, or if you'd rather, you can come into the mess room where it's warm for a while."

Kelton masked his eager curiosity. He had hoped for just such permission, for the walls of the mess room were lined with apparatus, and right through the meal two of the technical sergeants had remained on duty in the corner, earphones on their heads and a shrouded spy plate before their watchful eyes. What luck that he had lied about his rating! Really a clever machinist, he could now play dumb about the installations but gradually find out all about them. It would be useful, just in case he ever got away.

"This must be the station Pop Andrus was talking about," he thought. "That's an ordinary spy beam a good deal like ours. But the detector setup is

different." If he could only guess which moon! Some day he might get a break, and if he could then tell definitely where the station was located, perhaps his return to the *Beagle* might be less disastrous.

BY THE END of a week Kelton had become an accepted member of the little colony. Few of the Uranians were in the military service and little formality existed. Kelton had difficulty at times to keep from joining the shop talk that flew back and forth across the table and in front of the big fireplace. These big men spoke his language; and he could have entered many a technical argument with considerable pleasure. "But that would crab the works entirely," he decided. "Mustn't let 'em guess that I know the difference between a condenser and a cauliflower."

What little watch had been kept on his movements at first soon relaxed. How could he escape, and what could he do? Between meals he gradually took to walking about the station. Some parts of the building were denied him, and he was not allowed near the little hangars behind the building; but that did not matter. He did not need to go there. He knew about hangars, and he also knew enough about hydroelectric plans to make a very shrewd guess as to what was behind those closed doors.

Meanwhile evidence accumulated that this was indeed the spy station which kept the Uranians fully informed of the movements of the Terran fleet. The mountaintops on either side of the valley were joined by a network of mile-long aërials; and Kelton could hardly keep a gleam of admiration out of his eyes as he watched the sensitive tubes in the mess room pick up and chart automatically the location of ships half a universe away. "But doggone it," he mused, "what moon are we on? It's the one nearest Jupiter, but which one is that? And how can I get away from

here with the news?"

He was sitting on the floor by the fireplace one night, his head between his hands, mulling over his situation and frowning gloomily.

"Cheer up, runt!" cried one of the Uranians heartily. "It might be worse. You'd probably be getting your skinny neck broken by now if you hadn't been captured. Don't be so glum!" He reached into a locker and brought out a musical instrument like a ukulele and began to tune it. "Here," he said. "Listen and cheer up!" He began clumsily to thrum the strings and sing softly:

"When the war is done we'll all go home,
Heigh ho! Heigh ho!
We'll settle down no more to roam,
Heigh ho! Heigh ho!"

Something clicked in Kelton's head. *"Heigh ho! Heigh ho!"* he joined in, humming a tenor to the Uranian's air. IO! *That's* the name of this dump! IO, Jupiter's No. 1 satellite!

A slow grin spread over Private Kelton's face and he reached a hand toward the ukulele. "Rabbit," he said, "if you can't run, get out of the way and let somebody run what can run! You haven't got it tuned right, anyhow!" He quickly twisted the pegs and plucked a sequence of clanging chords.

"Now will you sing, or shall I?" In answer to his own question he began to sing at the top of his voice, his fingers flying and his eyes alight. "Now I know what to do!" he thought joyously.

The Uranians crowded around with broad smiles. "Prisoner, you're there! Sing some more!"

Private Kelton obliged. He sang gleefully, boisterously. He snapped trills and runs from the ukulele more intricate and rhythmic than he had ever accomplished before. "Doggone! I've got it now!"

IT WAS from then on an established part of the evening for Kelton to sing in the mess room. Now and then even the officers would come in to listen. Kelton bided his time—mustn't be too previous about this. It's too important. It wasn't easy to play the fool night after night, impatient as he was. Especially on nights when the conversation around the table told him there had been a raid or a battle.

His chance came one night when the chief electrician was celebrating his birthday and the glasses were filled with something else than water. The chief filled a wineglass and held it out to Kelton. "Here, prisoner," he said. "Take this down and you'll sing sweeter than ever tonight."

Kelton hesitated. "It'll make me drunk as an owl. Thanks just the same, but I'm afraid of it. That's how I came to be here—too much of that stuff."

"Phooey! One glass won't hurt you. Take it."

"Well," Kelton said reluctantly, "if I bust all the dishes in the pantry tonight, tell the steward it's your fault. Here's many happy returns, and he drained the glass. "That's good," he said sputtering a little.

Over his dishwashing his face set in a fixed smile and he swayed slightly; but his mind, clear as crystal, was working feverishly. He must not overdo it! Now or never, but it mustn't look like he was faking. He dawdled about putting the dishes away, rattling them noisily. So slow was he that the mess began to shout through the door. "Yea, prisoner! Music!"

Grinning foolishly, Kelton half lurched through the door, reeled a little and put a hand out to the wall to steady himself "I tole you," he said. "That wine's got me loppy. But gimme that uke!" As he tuned the strings he looked up, again smiling owlishly.

"On this festive occasion," he said. "I

will now proceed to sing a perfeckly new song. I made it up myself to commemorate my horrible captivity due to the evils of drinks like that you just gave me. This ditty, gennlemen, is entitled 'The Curse of Drink,' or 'I Wish I Had a Barrel of It!' Gennlemen, the sad story of Private Kelton!"

His fingers swept the strings, he hiccupped slightly and began to sing, a rollicking, lilting tune. The Uranians started to pat their feet and snap their fingers. "Join in, ever'body!" Kelton shouted as he reached the second chorus. "Ever'body sing it!" And Lord send that old Pop Andrus is on watch back there!

Twenty hearty Uranian voices bellowed the chorus. The officer of the watch came in to listen to the fun. "Hey!" he suddenly cried. "Who the devil left the mike switched on?"

THE *Beagle* was patrolling around the Asteroid Belt, and rather hopelessly searching for the elusive Uranian spy base. Pop Andrus himself took the detector watch most of the day and half the night. He missed Kelton sadly—a damned young fool, but a mighty good shipmate. Pop blamed himself for not searching for him that night, but Mellor had seemed so sure that Kelton had gone back to the ship. And the citizens of pillaged Marsopolis had told him about Kelton's capture by the Uranians. "Poor kid! I sure wish he was back here!"

Unusual sounds began to twitter in his earphones. Pop's eyes grew round. The executive officer, on his evening round of inspection, came in. "Mr. Stoney!" Andrus gasped. "Get an earful of this!" He threw the switch of a loudspeaker and the sound of confused conversation filled the room, mingled with plinking notes, like the tuning of a stringed instrument. Then came an inane, gigging voice:

"'The Curse of Drink,' or 'I Wish I Had a Barrel of It!' Gennlemen, the sad story of Private Kelton:

"In my prison cell I sit and dream,
(Cruisin' round the Pleidase all alone!)
In a big stone house by a tumbling stream.
(Orion's tootin 'on his saxophone!
Twin mountaintops are capped with snow,
(Roamin' the Galaxy all alone!)
The waterfall roars in the gorge below.
(Nobody's fault but just my own!)

"I-O! I-O!
I've been a foolish lad!
When you go on a binge and miss
your ship,
By Jupiter, you're in bad!

"Oh, everything was bright and fine,
(Cruisin' round the Pleiades all alone!)
Till I drank a quart of Martian wine.
(Orion's tootin' on his saxophone!)
So here in a prison cell I sit.
(Roamin' the Galaxy all alone!)
Old Pop's dead right, I should never get lit!
(Nobody's fault but just my own!)"

Commander Stoney's lower jaw dropped in amazement. "Sufferin' Cephus!" he gasped. "Can that be Kelton?"

"It's Kel, right enough. I was there when he made the song up," Andrus whispered.

Through a clatter of applause and a stamping of feet the tenor again rang out of the speaker. "Join in, ever'body! Ever'body sing it!" a score of roaring voices took up the refrain.

"I-O! I-O!
I've been a foolish lad!
When you go on a binge and miss
your ship,
By Jupiter, you're in bad!"

A clamor of applause then a sudden silence cut by a sharp voice, "Hey! Who the devil left—"

With a click the speaker went dead

Old Andrus' voice was shaky. "The clever kid! Io, by Jupiter!"

"Got a tape of it?" shouted Stoney. "Hurry, let's get this to the captain!"

"I know the very place!" cried Cap-

tain Carroll jubilantly when he had heard the record. "I was there looking for bauxite eight years ago in the old *Proteus*. Look!" and he rapidly thumbed through a book of photographs. "Twin peaks and a high cataract! There isn't another place like it on Io! We must get this to Colonel Brumby at once!"

TWO NIGHTS later Private Kelton was glumly clearing the table. He had tried, but it looked as if he had failed. He couldn't sham drunk and snap the mike switch another time. That would be too phony for the Uranians to overlook. Oh, well! He had done his best. Maybe he would have another chance some day.

The man on watch at the detector gave a sudden gasp. "Orderly!" he yelped. "Tell the lieutenant a whole enemy squadron is heading straight in!"

Hardly had the officer in charge reached the mess room when the big communicator screen blazed. Colonel Brumby's square face showed sternly, and his deep voice rolled through the speaker.

"Calling the Uranian station below! You have fifteen minutes for reply. If within that time you indicate surrender by lighting a red flare, you will be allowed to remove your personal belongings and will not be harmed. If I see no flare in fifteen minutes, your entire station will be destroyed."

The startled Uranians stared helplessly at each other. "And our fleet's over twenty hours away, the nearest of 'em," muttered the man on watch.

The officer in charge straightened his shoulders with a short, bitter sigh. "No choice, lads. Poral, go burn a red flare on the roof. Meanwhile—" He picked up a heavy chair and swung it crashing into the maze of tubes and wiring. "They won't get any use out of this setup. Demolish everything! Smash it beyond repair!"

PRIVATE KELTON, again trim in a black-and-gold uniform, was still dazed with happiness as he left Captain Carroll's cabin.

"In view of the valuable aid you gave us in wiping out the spy station, the mark of desertion has been removed and you will not be disciplined," the captain had said. "But I hope this will teach you a lesson. Sooner or later, your careless and offensive conduct is going to get you in real trouble. This time I am glad to overlook it; but I can't promise always to be patient with you. Meanwhile, I am glad you're back safe, and here's my hand on it."

Kelton took the advice to heart for nearly an hour. He had been an awful fool. Getting drunk and missing ship and shirking—all that was silly and smart-Aleck. He would do better. He would turn over a new leaf—

Sergeant McClure, his lantern jaws set sternly, paused beside him and frowned. Up through the dynamo-room hatch rumbled the voice of old Andrus, singing the song that was now the rage of the ship. *"Io! Io! I've been a foolish lad!"*

"You're lucky!" snarled McClure. "You've been a bum ever since you enlisted. Why don't you try to act like a man?"

Resentment burned in Kelton's cheeks. "Like you, sarge?" he asked flippantly.

"You might do worse! I don't jump ship and desert in wartime! If I'd been the captain I wouldn't have let you off so easy. You're lucky to miss a firing squad!"

Private Kelton shrugged his shoulders, and the old bravado came back to his face. Old McClure and his everlasting preaching—bah! It's worth getting into a little trouble now and then just to show him he isn't so much!

"Aw, nerts!" said Private Kelton impolitely.

DESIGN FOR LIFE

A closely reasoned and unique article in which Mr. de Camp analyzes Earth's life-forms, and synthesizes probable forms for extra-terrestrial intelligences. Life-forms don't happen—they're designed on sound mechanics!

By L. Sprague de Camp

Illustrated by L. S. de Camp and Willy Ley

GRIPPING the butt of his ray-pistol, Richard Farnsworth strode fearlessly over the soil of this strange planet toward the creatures. There were about twenty of them. As tall as a man, they resembled huge purple spiders. The leader held a gun of some sort in its many-jointed legs. The emotionless stare of the thing's compound eyes fascinated Farnsworth. It seemed to have a hypnotic effect—"

That, no doubt, sounds familiar to science-fiction readers. I was moved to concoct that fragment as a result of running through a file of magazines and comparing the ideas of the writers on the form that intelligent extra-terrestrials might have. The authors are nothing if not industrious in devising a variety of shapes for their e.-t.'s.

If we consider only intelligent extra-terrestrial life-forms, and only those on plain, ordinary planets—ruling out those that allegedly flit around in other dimensions, or are sub-microscopic or supergalactic in size—we find the e.-t.'s in the form of men, even as you and I. I assume that both the reader and I are human. There are also near-men, or men with a difference: tall men, short men, fat men, skinny men, men with oversized ears, men with scales, men with extra arms, etc. There are e.-t.'s in the form of gorillas, lizards, turtles, and crickets. There are e.-t.'s that look like sow-bugs, marine worms, sea anemones, and the more eccentric kinds of women's hats. There is even one e.-t. that looks like a ticker-tape machine. There are e.-t.'s that are practically nothing but brain. There is an e.-t. that can look like anything it pleases. The list can be extended indefinitely, and even so it doesn't take into account the animated crystals, the assorted metallic, gaseous, and electrical entities, and the disembodied intelligences.

But, if intelligent life did develop on another planet, it is very unlikely that it would look like a chrysanthemum, or a starfish, or a fire hydrant. There are good reasons for thinking that it would probably look *something* like a man, at least at a sufficient distance.

Some of us may have asked ourselves: How do these imaginary life-forms stack up against what we know about the nature and limitations of life? Which are possible and which impossible? If "impossible" is too dogmatic a word, which are more and which less probable? Which would a biologist admit to be plausible, and which would he damn as phony?

Let us state our problem this way: Given a planet that has been going for a couple of billion years, like our own earth, so that it has had time for intelligent life to evolve. Given, that such life does evolve. Question: "What might it and might it not be like? To use the sound principle of working from what

we know to what we don't, we shall assume that the planet is like the earth with respect to size, mass, chemical composition, atmosphere, amount of surface water, temperature, speed of rotation, and inclination of axis. Perhaps we can branch out to other kinds of planets later.

WE SHALL have to proceed by looking at life on the one planet whereof we do have firsthand information, to see what principles, if any, we can derive as to how life on other planets might evolve. Our extrapolation of these principles to other planets will be guesswork. But it will be better than purely random guesswork, because we shall have loaded the dice just a little bit in our favor by throwing out a lot of obviously bad guesses at the start.

To make the problem manageable at all, we shall have to rule out the animated crystals, the gaseous and electrical beings, and the disembodied intelligences. It isn't that we know such things to be impossible; we don't know whether they are or not. But if we assumed that they are, there is nothing like them on earth, and hence we haven't the faintest notion of what they would be like or how they could evolve. We do have some idea of how earthly life works. But no terrestrial scientist has examined a disembodied intelligence, wherefore we have no idea of what sort of metabolism or reproduction it would have. Trying to describe a hypothetical being of that kind would be the purest of random guesswork, and would get us nowhere.

Trying to imagine a plausible animal that will succeed in earning its living in a given environment is something like a problem in engineering. If several engineers undertake to design a bridge, one may produce a suspension bridge, another an arch bridge, and another a cantilever bridge. If we have a lot of engineers, they may produce several designs for a bridge of each kind. But all the suspension bridges will be fairly similar, and so will the arch bridges, et cetera. One efficient design for a suspension bridge of given length and capacity is pretty much like another.

WE FIND that evolution works in a similar manner. To any given problem there are several broad classes of solution. At this point I am going to use the term "phylum" in the sense of a single line of descent. Thus you might say that you and all your near relatives, including uncles, cousins, and nieces.

Fig. 1. "Giant Ameba Attacks New York!" Illustration of his probable degree of success when up against dry-land gravity.

constitute a family, but that your grandfather, your father, yourself, and one of your children constitute a phylum.

Once a phylum has adopted one of these methods, the result will be very much like that produced by another phylum that adopts the same method, however far apart the phyla may be from the point of view of ancestry and however much the solutions may differ in small details. Of course the more specialized a phylum becomes in one direction, the less good its chances are of switching off in an entirely different direction. A given evolutionary change is possible only if it can be accomplished in short steps, without too sudden a change in fundamental organization or too drastic a reversal of a long-established evolutionary tendency.

For instance, to make a salamander into a science-fiction writer merely requires a sufficient number of minor changes of form and proportion along lines already established in the phylum, with the addition and subtraction of a few parts and organs. But to do the same thing with a beetle would be something else. The insect would have to back down its branch of the tree of life to somewhere among the segmented worms and virtually start all over. Which is something that phyla, on earth at least, simply don't do.

Evolution from different starting points toward a common result is called *convergence*. The animal kingdom is full of examples. For instance, take the problem of driving a bulky body rapidly through the water. The accompanying illustration shows how this has been worked out in a number of different phyla. One of the most effective methods is to wag some sort of fin at the hind end of the body, the fin being flexible enough so that there is a forward component of the thrust of the water against it. We may call animals that adopted this method the scullers. Examples are shown in the porpoise—a mammal; the ichthyosaur—a reptile that lived during the Age of Reptiles, which ended about sixty million years ago; the tuna—a fish; and the shark—a fish or not, depending on what system of classification you use.

These four scullers look remarkably alike, although the porpoise and the ichthyosaur are descended from land-animals that did not look in the least fishy. Among the minor differences in the solutions are the fact that the porpoise wags his tail up and down, where the others move theirs from side to side. Also, in the shark the backbone extends into the upper lobe of the tail fin, in the ichthoysaur it extends into the lower lobe, and in the other two it does neither. When the first ichthyosaur skeletons were found, the finders wondered why their backbones turned down sharply near the end. A specimen in which the skin impressions were preserved, showing the tail and dorsal fins, solved the mystery.

ANOTHER solution of the swimming problem is shown by the rowers. This time we have a modern mammal, a modern bird, a modern reptile—the turtle; and an extinct reptile—a plesiosaur—that was a contemporary of the ichthyosaur. One branch of the plesiosaurs did, in fact, become a race of pseudo-turtles, complete with beak and shell, quite independently of the true turtles. A curious fact is that the fish tried this method of swimming back before the Age of Reptiles, dropped it—or rather, the phyla that tried it went pfft—and never revived it. For straight-away speed, sculling is possibly a little more efficient. But a seal can go like a streak after a fish, which is the more remarkable when you consider that he uses his fore flippers only for propulsion, reserving the hind ones for steering.

Among the wigglers, those that swim by undulating the whole body, we find no mammals or birds, though the fossil

whale Zeuglodon had such a long tail that he might be classed as a wiggler. But a number of reptiles, amphibians, and fish use this method. Of the two reptiles shown the mosasaur was a kind a sea lizard, reaching in some species a length of thirty feet. Both it and a marine crocodile (Geosaurus) that lived during the Age of Reptiles were probably exclusively aquatic, being unable to crawl out on land—though both were descended from land reptiles.

THERE are other ways of swimming, such as the fluttering method, which consists of undulating a projecting fin or flap. This is found, for instance, in the sting-ray, the sea horse, and the electric eel. There is the jet-propulsion method used by the cephalopods—squid and octopus—and the dragon-fly larva. There is what we may call the sea-anchor method, which consists of extending a hoelike appendage and jerking it toward you. That's how the lobster flaps himself backwards to safety with his tail when seriously alarmed. I call it the sea-anchor method because of its resemblance to a method formerly used to move becalmed sailing ships. A dory load of sailors would row away from their ship, taking with them a sea-anchor, which was a thing like an overgrown beach umbrella, connected to the ship by a rope. When the rope had been all payed out, the sea-anchor would be dumped overboard. Other sailors on the ship would then walk the capstan round with a yeo-heave-ho, winding up the rope, pulling the sea-anchor back to the ship and, by the same token, pulling the ship forward to the sea-anchor.

But these other methods of swimming may be compared to such odd forms of bridges as lift spans and rope bridges; good under special circumstances only. Considerations of the same sort govern the selection of materials. No competent engineer would specify that the cables of his suspension bridge should be made of porcelain, for instance, however useful porcelain be in teacups.

IN THE PRESENT article, let's examine the fundamental questions of our extra-terrestrial's biochemical constitution, habitat, and size. I hope to go into the details of his physical form and organs in a subsequent article.

The first question about the inhabitants of our imaginary planet is: What are they made of? Or rather, what *could* they be made of? Earthly life without exception is made of carbon compounds. The parts of earthly life-forms that most clearly show the properties of life are made of carbon compounds with enormously high molecular weights and molecules of immense complexity. Some simpler compounds will under certain circumstances show some of the characteristics of life—mobility, reproduction, et cetera—but never all of them, or even enough of them to raise any serious question as to whether the compounds are alive or not.

The next question is: What is there about carbon that enables it to form these compounds? Carbon is chemically an extraordinarily versatile element. Especially is it unique in its ability to form compounds in which the carbon atoms are strung together in long chains, to which the accompanying hydrogen, oxygen, nitrogen, and other atoms can be attached in a vast variety of ways. Hence when you have one of these large and complex molecules, the number of possible things you can do to it is legion. The high elastic limit—stretchability—of some organic compounds also seems to depend on the chains. The carbon atoms are connected in a zigzag or in a helix, and can be pulled out and will snap back like a bedspring. Since the molecules of which living matter is made are all of this complex type with chains, and since none of the thousands of simpler compounds show any signs of life, a fair inference is: no chains, no life.

Do any other elements form chains to anything like the extent that carbon does? No. The next best is silicon, which comes directly below carbon in the periodic table. For instance, it forms a series of hydrides corresponding to the paraffin series—$C_nH_{2-n^2}$—that are called silanes. But the highest member of the series that is at all stable under earthly conditions is silicobutane, Si_4H_{10}, the fourth member. The higher silanes oxidize the minute water or free oxygen hits them. So a planet that would support silicon life, even if we assume that silicon will form long-enough chains—which is doubtful—would have to be completely without water and free oxygen, at least on the surface. Such a state of affairs is, to say the least, hard to visualize, oxygen being one of the commonest elements in the universe.

BORON, carbon's left-hand neighbor on the table, also forms some compounds analogous to those of carbon. But on the whole boron is no more promising as a base for life than silicon. Carbon's right-hand neighbor, nitrogen, is an essential constituent of living matter, and is, in its way, a versatile enough element. But it does not form chains—by itself, that is; nitrogen atoms sometimes act as links in carbon chains. It forms only three hydrides, and its behavior is on the whole so different from that of carbon that we can throw it out without further ado. Much of the same comment applies to phosphorus. The elements below boron on the table, titanium, zirconium, hafnium, and thorium, are all definitely metals and are only remotely carbonlike in their behavior.

So we can begin the construction of our hypothetical e.-t. by saying that it would virtually have to be made of carbon. Writers can, if they want, continue to imagine boron or silicon monsters. But they'd better assume conditions of temperature, pressure, et ctera, so different from those on earth as to make chain-forming properties for these elements at least halfway plausible.

If Dmitri Mendeyeev—also spelled -leev, -leyev, -leeff, -lejeff, -ljeff, and a few other ways, and pronounced mend-yell-*yay*-eff—had not put forth his famous periodic law about seventy years ago, we should be at liberty to hypothesize various unknown elements with chain-forming properties, as bases for our imaginary life-forms. Nobody could prove us wrong. But as a result of Mendeyeev's work we know not only what elements do exist but what elements *can* exist. The gaps in the original periodic table have been practically all filled in. So the only elements that we are at liberty to imagine, without going contrary to ascertained fact, are extremely heavy metals, like uranium —only more so—and isotopes of known elements. The super-heavy metals would probably be radioactive; anyway it's probably not a coincidence that the main constituents of protoplasm, carbon, oxygen, hydrogen, and nitrogen, all come from the *top* of the table—that is, they have low atomic weights. The isotopes of known elements would be almost identical chemically with the known isotopes of those elements.

The situation is like this: suppose no reliable records of the history of the United States existed for the period before 1850. Then, if I were writing a historical novel laid in 1810, I would invent a president named Theocritus K. Woggon for that period, and endow him with a complete set of imaginary characteristics. Nobody could prove that I was a liar. But, unfortunately, we know who all the presidents were, and there is no unknown period in our history into which the novelist could wedge his imaginary president without saying something that just isn't so. You might say that this marks one difference between science-fiction and fantasy: In science-fiction we try not to go contrary to known fact, however thinly we may

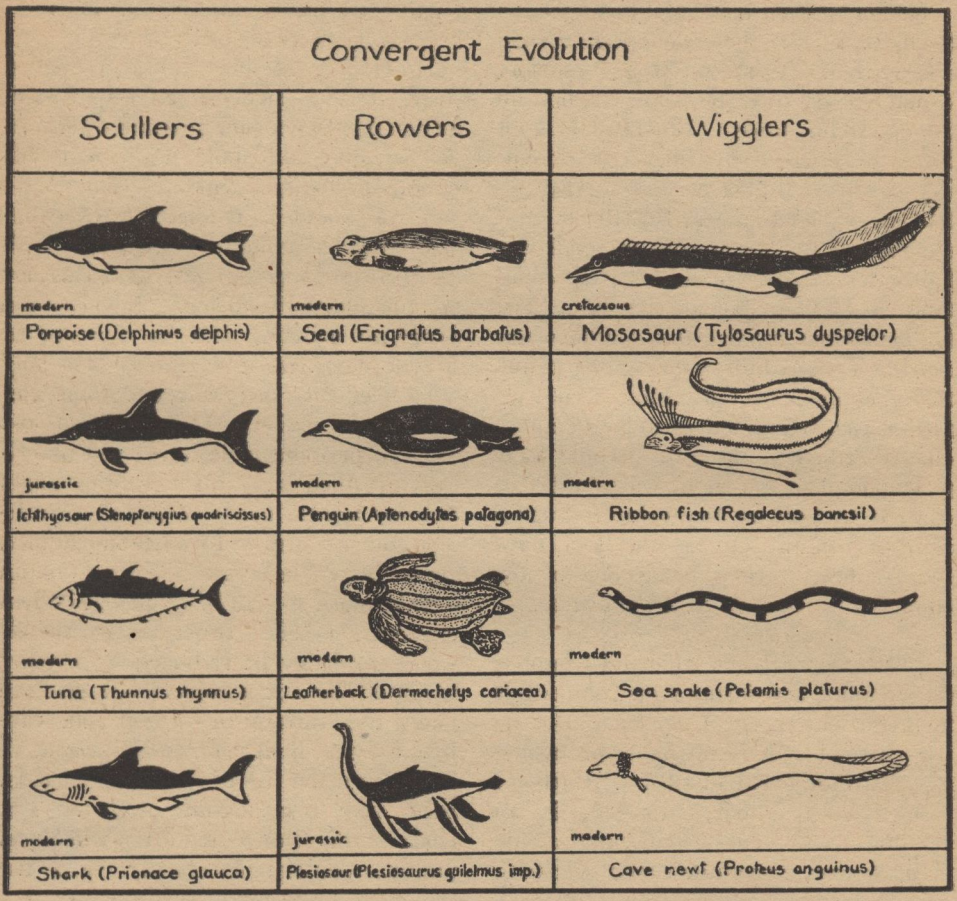


Fig. 2. Twelve different life-forms, of three widely different types—mammal, bird, and reptile—faced by the same problem, driving a bulky body through water, solve it in the same three ways. Countless millions of years of evolution, an immense difference in race history, and a fundamental difference of metabolism separate the porpoise, the icthyosaur, and the tuna, yet each solved the same problem the same way.

spread our speculations about the unknown. In fantasy we dump overboard any known facts that happen to be inconvenient.

WHAT SORT of metabolism would our e.-t.'s have? Again, it's a matter of design. It depends on what you want the organism to do, just as your selection of motive-power for a boat depends on whether you're going after a catch of tuna, the north Atlantic passenger trade, or the *America's* cup.

On earth, all the animals big enough to be seen with the naked eye use oxidation and reduction reactions. Organic compounds furnish both the raw material for the reductions and the fuel for the oxidations. The reduction of some of these compounds is necessary to use them in building up new living matter, that is, for growth. To provide the energy for this process, and for the animal's other tasks, such as moving about and—among some forms—maintaining a body temperature above that of the surroundings, the greater part of the animal's food is oxidized—in a sense

"burned"—to carbon dioxide and water. Most of the one-celled creatures do likewise. But some of them, the autotrophic bacteria, vary the pattern by oxidizing, not organic compounds, but such things as iron to ferric oxide; sulphur to sulphuric acid; and ammonia to nitric acid. The things that some bacteria can do to nitrogen and its compounds are a story in themselves.

The visible plants have an entirely different metabolism. They need several raw materials: the carbon, oxygen, hydrogen, and nitrogen of all living matter, and smaller quantities of many other elements such as sulphur and phosphorus. The carbon and oxygen they take out of the atmosphere in the form of carbon dioxide; before they can use it, it must be reduced, which takes energy. The other elements they get from the ground. To hoist these substances—inorganic salts and such—up their stems takes more energy. They get the energy directly from the sunlight by the process called photosynthesis. This useful term, by the way, is an illustration of the fact that giving a process a name doesn't explain it. For, though we know what we mean my photosynthesis, we don't know yet just how it works, although a lot of research has been done on it.

But that isn't all. There are a number of bacteria whose metabolism is a kind of "oxidation" without oxygen, called fermentation. Their raw material and fuel are organic compounds, such as sugars. But the end-products of fermentation, instead of being carbon dioxide and water, are carbon dioxide and any of a number of organic compounds such as alcohols or organic acids —lactic, butyric, acetic, et cetera. These bacteria are called anærobic, the name referring to the fact that they get on without oxygen. Some bacteria can switch from anærobic operation to oxidation-reduction operation and back again, according to whether there is oxygen available.

WHICH SYSTEM would our e.-t.'s follow? Remember, we're looking for an *intelligent* form of life. An intelligent being would almost certainly be an active one. Animals and plants do not ordinarily develop structures or shapes for no reason at all, except sometimes as a secondary result of a mutation that was favorable in some other respect. It seems altogether unlikely that any form would develop a structure so complicated as a thinking brain unless that brain were of some practical use to it in its business of eating and avoiding being eaten. The main excuse for a brain is not that it enables its possessor to play bridge or read magazines, but that it enables him to make correct decisions when faced with problems on whose answer his survival depends.

That means that such a form must live a life that presents it with problems, and be so constituted otherwise that its ability to solve them will do it some good. An oyster has few problems. The water brings its food. Its shell is an adequate shelter and, against most enemies, protection. Of course, if a hungry starfish finds it, it will die. But, even if it had a brain good enough to compose a whole book about starfish, what good would that do it? Fastened to its rock, it can neither run, hide, nor fight. This disposes of the intelligent plants and other immobile forms—including Weinbaum's immortal Oscar.

Whether a given phylum develops mobility seems to depend mainly on the difficulty of getting food. If their food is brought to them by wind and water, they don't chase around after it. As there are plenty of microorganisms in the water or carbon dioxide in the air, a clam or a catalpa tree stays put and lets the currents do the work. They may be eaten by some more active form. But apparently it is more practical to

offset this danger by developing a passive defense of shell, spines, or poison, than to evolve the elaborate apparatus necessary to enable the victim to flee.

That eliminates photosynthesis, one of whose essential characteristics is that it works on a ubiquitous fraction of the atmosphere. A somewhat similar objection applies to active organisms of the autotrophic type. You don't have to stalk or chase sulphur. Of course, you don't have to chase plant food either. But most of our active contemporary vegetarians, such as goats and grasshoppers, seem to be descended from carnivorous forms. If you go back far enough, you find that their ancestors were water-animals, and nearly all water-animals above microscopic size are carnivorous. The reason is one of size: Nearly all water-plants, except such things as kelp and marsh plants, are microscopic, and the animals that feed on them have to be microscopic, too, in order to make a living. The just-visible animals, like water fleas, are small enough to live on the larger microscopic animals, but too big for the microscopic plants, and so on up the scale.

That leaves us a choice between the oxidation and the fermenation of organic compounds. When we look at the amount of energy derived from the oxidation and the fermentation of a given amount of food, we see at once what an enormous advantage the former process has. If you ferment one gram molecule of grape-sugar, $C_6H_{12}O_6$, to lactic acid, you get 18 calories of energy. If you ferment it to ethyl-alcohol, you get 28 calories. But if you oxidize it to carbon dioxide and water, you get 674 calories!

So you can imagine that if your metabolism changed overnight to one of ethyl-alcohol fermentation, you would have to eat 25 times as much as you do now, if you wanted to lead the same kind of life as before. If it were changed to lactic acid fermentation you would have to step up your food consumption 37 times! Although I am a notoriously hearty eater, I should be aghast at the prospect of having to eat a dinner of 37 steaks, 37 orders of French frieds, 37—br-r-r! Even if my eating and digesting mechanisms were adapted to this task, I should almost certainly have no time left for writing articles after finishing my 37th slice of pie and 37th cup of coffee.

The practical difficulty of developing a large and active animal with a fermentation metabolism is obvious. If the planet had no free oxygen floating around, life might perforce be limited to anærobic forms. But it seems unlikely that such forms would be able to evolve much beyond things like our own flatworms: aquatic, simple, sluggish, and unambitious.

If photosynthesis once appeared, free oxygen would be released into the atmosphere. Before many millions of years had passed, the oxidation metabolism would have become a practical proposition. Once oxidation-metabolism life got started, it would have little difficulty in routing the fermenters, even though the latter had the advantage of a head start. By comparison you might say that the gasoline automobile's more efficient metabolism enabled it to rout the electric. For one thing, it doesn't have to carry all its fuel around with it. Oh, no, it doesn't; it gets half of it out of the air. Electric automobiles, like anærobic life-forms, survive in a few odd cases, like that of bakery trucks, where their peculiar qualities give them the advantage.

WOULD our e.-t. be single-celled like an ameba or many-celled like a mussel or a man? Well, which would a competent designer select? Intelligence seems to be a form of behavior that requires a highly organized nervous system, which means a complicated electrochemical apparatus consisting of separate

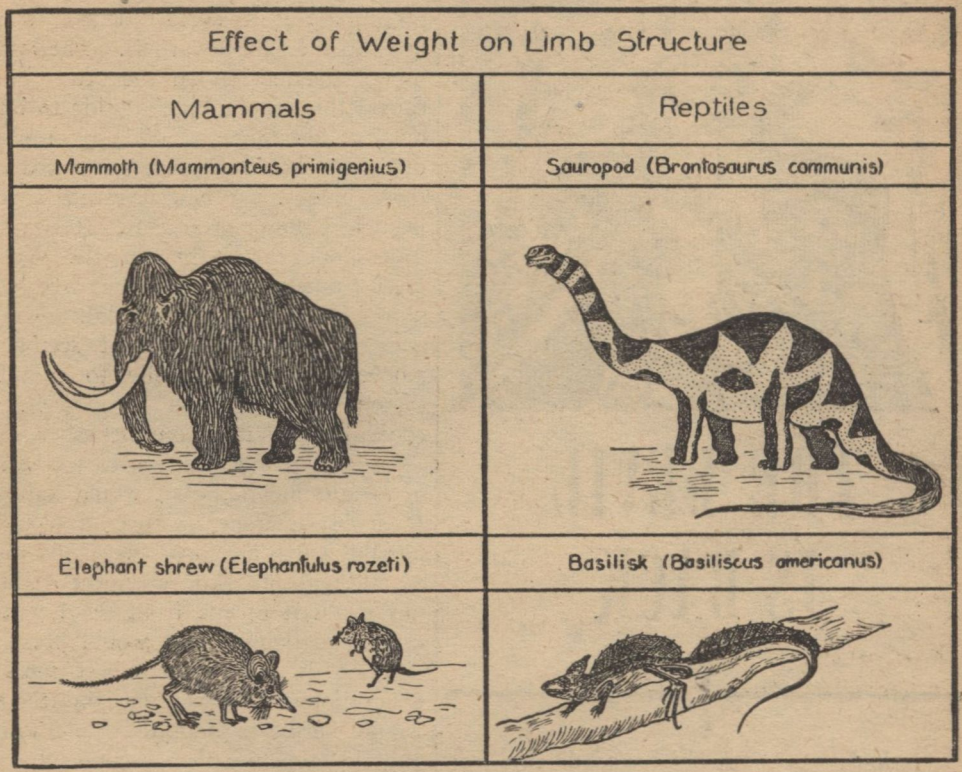


Fig. 3. Similar problems of carrying heavy or light weight on feet in widely separated lines of evolution are solved in the same way. At top, a heavy mammal and a heavy reptile; at bottom, light mammal and light reptile. The heavy animals developed massive, columnar legs with short feet; their legs are practically straight in the normal walking position. The light animals have proportionately slender legs which are normally flexed.

Ley, incidently, in illustrating the Brontosaurus, suggests coloration in the typical reptilian manner. Since no knowledge of their coloration is obtainable, they are usually shown only in gray, but the tendency to gaudy vests and striped pants seems to be even more characteristic of the modern reptiles than of man.

The Basilisk is unusual among reptiles in being capable of sustained, extremely swift movement. It is locally known as the "Jesus Lizard" because of its habit of escaping enemies by walking off across the surface of a pond or other water. Actually, it runs as a biped, and so swiftly that its slight weight does not sink its feet into the water before a succeeding step is taken. The performance is somewhat disconcerting to an observer—or an enemy!

nerve cells. And if it has separate nerve cells it obviously is not unicellular. Moreover, our intelligent creature would have to be a fairly large and active form. To move a large body around the way we move ours requires muscles—consisting again of large numbers of specialized cells. The protozoans have simply no structures to enable them to think, read newspapers, or build houses. The more active ones move by more monotonous jerks of their protoplasmic hairs. If they were enlarged to human size they would be no better off.,

Here we might dispose of the giant amebas with which so many writers have threatened their characters' lives. An ameba is actually a sluggish little creature whose behavior is about as simple as a mobile animal's could be. When it

feels the urge to move from A to B, chemical changes take place in its protoplasm, so that its surface tension is lowered on the side toward B. The lowering of the tension on the "front" side causes the surface on that side to bulge out into pseudopods. The protoplasm of the ameba's body flows forward into these bulges. When it meets a food particle it flows around it. It seeps or leaks along, rather than crawls. Watching an ameba under the microscope requires lots of patience. I did, however, once have the pleasure of seeing an ameba try unsuccessfully to engulf a diatom that was too big for it. It couldn't quite meet on the other side!

If you expanded an ameba to the size of an automobile, what would happen? If it were under water, it couldn't possibly catch any prey that could move at all, with its slow chemical drifting, nor could it escape from the horde of crabs and dogfish that would presently descend on it for their best meal in generations. If it were on land, the end would be more definite yet: Lacking any skeleton, muscle, or connective tissue to hold its shape against the pull of gravity, it would be flattened out by its own weight into a thin layer of slime.

As a matter of fact we do have, on earth, something rather like the giant land-protozoans of science-fiction: the slime-molds or slime-fungi. A husky slime-mold consists of a mass of gooey protoplasm about the size of an ordinary pancake, with thousands of neuclei embedded in it. They are found in damp places such as decaying logs, through which they seep, digesting rotten wood, fungi, or bacteria, depending on the species. But to make menacing monsters out of these obscure and formless creatures would take some doing. They do move, but at a speed like that of the day-of-the-month hand on one of those elaborate clocks that tells you how high the tide is in Rangoon.

SO LET'S agree that our e.-t. would have to be multicellular. Would it be

a land or a water animal? We can't answer this question as definitely as the preceding. But a little consideration shows that the land is decidedly more probable as its habitat. Intelligence, on our own earth, seems to be definitely associated with a wide and varying environment—which will present the animal with new situations and hence make its intelligence of some practical use. Moreover, the habitat should be such that the animal can profitably develop its senses to great keenness, especially the sense of sight. In both respects water is decidedly inferior to land. Water is a dim sort of world. Even under favorable conditions, as around some tropical shores, maximum clear vision is measured in tens of feet. If the water is full of mud or microscopic life, vision is cut down still further. Accordingly, while we find well-developed eyes of the camera type among the fish and the cephalopods, their powers of vision are much inferior to those of land vertebrates. And at great depths there is nothing to see at all, except the luminous patches with which many deep-sea animals are decorated.

If we stay near the surface, where vision of a sort is possible, we run into other difficulties. The open sea is about as monotonous an environment as can well be imagined. So little adaptability is required of its inhabitants that most pelagic fish don't even have reflexes to enable them to avoid, or back away from obstacles. That is one reason why you don't usually see mackerel in aquaria; they would butt themselves to death against the sides of their tanks. They can be kept only in a large number and in a large circular tank, under which conditions they mill around in a perpetual circle. If the circle is broken, they begin diligently bashing their heads in again until the living doughnut is reformed.

Along the shore there is more variety, but this environment is small geographically. An inshore fish or crustacean, for instance, might be limited to the bottom between depths of ten and fifty feet. Nearly all marine life is sharply limited in its vertical range because of the rapidity with which pressure and illumination change as you go up or down. That means that this animal's total range is a long narrow strip along the shores of a continent.

Living on land not only encourages greater development of the nervous system for these reasons, but the mere fact of having to hold up and move around the weight of your body against the pull of gravity, instead of having it buoyed up by water, requires a more complex structure and better neuro-muscular coordination than is required of water-animals.

Thus, although intelligent water-life is not inconceivable, the chances of its developing seem to be less than those of intelligent land-life. All we have to judge by is what we see here on earth. All the most intelligent animals on earth have developed on land—unless we count the sea-lions, which are descended from weasellike carnivores that have gone back to the water after a hundred million years or two on land. Water-animals have had a much longer time to do their stuff. If our imaginary planet had no dry land at all, and if intelligent water-life is in fact impossible—which we don't know definitely—our planet would never develop intelligent forms no matter how long it waited. But we have assumed that it has continents comparable to ours.

HOW BIG would our e.-t. be? Mere physical size has a lot to do with what kinds of animals are practical. You saw what happened to our ameba when we enlarged it, though it gets along well enough within its proper size-range. If we shrank a man down to ameba-size he would run into difficulties just as lethal, such as the more rapid loss of

body-heat. A living cell of any kind depends for its proper functioning on a lot of conditions. A muscle cell contacts when a chemical change increases its surface tension, so that it tries to change its shape from that of a string bean to that of a golf ball. If you enlarged it too much, the surface tension would be unable to handle the increased mass. If you shrank it sufficiently, its surface tension would be so strong in proportion to its size that it would be shortened up in a perpetual cramp. Other considerations, such as the ability to pass chemicals through its walls, and electrical resistance, enter in. Presumably nerve cells are subject to the same limitations in size as cells of other kinds.

And, in fact, when we look at animal tissues under the microscope, we find that, while we get huge variations in size of animals belonging to a single group, the size of cells in corresponding organs in these animals varies comparatively little. To take an extreme case of variation, the cells lining the foregut of the big Ceylonese milliped *Spirostreptus stenorhynchus* have only about 14 times the mass of the corresponding cells in the British milliped *Cylindroyulus londinensis*, though the Ceylonese milliped has over 60 times the body-weight of its little British cousin. *Spirostreptus* naturally has to have more cells in the lining of its foregut to make up the difference. And this variation in cell-sizes was recently reported in *Nature*—the British periodical—as the biggest that anybody had ever heard of among such closely related animals! With most kinds of cells a variation of two or three times the minimum size is about as much as you look for.

SINCE there are top and bottom limits to the size of the individual cells if they are to work properly, their maximum number depends on the *size* of the animal equipped with them.

"Intelligence" is an annoyingly vague term. We can pin it down somewhat by defining it as either of two rather different things: first, the ability to learn by experience, or, to put it in fancier language, to form conditioned reflexes in response to new stimuli; second, the ability to solve a problem in your head without having to fumble around until you hit on the solution accidentally. Most chordates and some invertebrates can learn—the first kind of intelligence. For instance, a fish can learn where a hole is in a pane of glass across his tank between him and his food, and thereafter go through the hole every time without bumping his nose. The only animals in whom reasoning—the second kind of intelligence—has been established are man and the chimpanzee. The gorilla and the orang-utan may have this ability also, but, as they are inclined to be morose and un-co-operative in captivity, the question has not been settled.

Mere complexity of behavior, such as occurs in the social insects, should not be confused with intelligence. The insects' elaborate behavior is not the result of previous experience, but is inborn, that is to say instinctive. They respond to stimuli as surely and as unintelligently as an alarm clock. Naïve persons sometimes insist that ants and bees must be intelligent to do the things they do. But a savage would have just as good a reason for insisting that an automatic telephone exchange is alive.

The ant's abilities seem to be a matter of connections between the nerve cells in the brain, the neurons. We can be fairly sure that intelligent behavior requires a much larger *number* of neurons than even the most complicated forms of instinctive behavior on earth. A man has about nine billion neurons in the cortex or outer layer of his cerebrum or forebrain, which in him has been enlarged until it virtually covers all the rest of the brain. An ant's brain has something on the order of one-millionth the mass of a man's, and probably has something on

the order of one-millionth the number of neurons. A mere ten million neurons are quite enough to endow the ant with almost as great a variety of automatic responses as the telephone exchange. But it is quite insufficient to handle the vastly more complex process of reasoning.

So it is a reasonable inference to say that our e.-t. couldn't think unless he had a number of neurons comparable to that of man. We can't set a definite lower limit to the size of our e.-t.'s. But two of the smartest of nonreasoning animals are the fox and the wolverine, animals of somewhat similar dimensions. Below their size learning-ability falls off rapidly. It may be that a reasoning animal would have to be larger than either. It probably could not be smaller, the size of the domestic cat, for instance. My own guess at the maximum size of a reasoning animal is about that of an Irish terrier, which weighs, when grown, forty or fifty pounds.

MAXIMUM size is limited by mechanical considerations, and not, as far as we know, by considerations of numbers of neurons. As long as the animal is big enough to carry around a brain of 1,000 cubic centimeters or more, it doesn't matter how big it is. Another of the most intelligent of nonreasoning animals is the elephant. Size is limited by the familiar rule of squares and cubes. If the size of a thing is varied while its shape and density are not, areas vary as the square of the dimensions and masses vary as the cube. The pulling-power of a muscle is proportional to its cross-sectional area. Therefore, if you triple the length of an animal, you multiply its weight by 27, but its strength only by 9. Unless you alter its shape to give it proportionally bigger limb-muscles, you soon reach a stage where the animal is unable to carry its own weight around or even to stand up. The strength in compression of the limb-bones varies in a somewhat similar manner, but here the formula is more complicated, requiring

The wolf, being unspecialized as regards fighting weapons, was forced to develop brains to offset his mechanical lack.

The great cat, sprouting weapons at all available points, is so decidedly a killing machine that less brain-power is needed.

consideration of the shape of the bone's cross-section.

The biggest land-animals that we know of are the sauropod dinosaurs of the Jurassic period, such as *Brontosaurus*: plant-eaters with elephantine bodies, long necks and tails, and small heads. The largest so far discovered, *Brachiosaurus,* may have weighed something like forty tons. If this isn't the practical limit to a land-animal's size, at least on earth, it is probably close to it. Scientists long wondered whether these creatures could walk on land at all, or whether they were confined to the lakes and rivers where the soft water-plants they ate grew, and where their weight would be buoyed up by water. Purely aquatic animals like whales have no difficulty in running their weight up to ninety tons. Dr. R. T. Bird of the American Museum of Natural History recently settled the question. In Texas he found the tracks of a sauropod that had walked down one bank of a river, crossed it, and walked out on land on the other side. But the reptile's feet had sunk into the ground two feet at every step. We can imagine the beautiful sucking noises those feet made when they were pulled out of the mud!

There are, true, a few objections to very large reasoning e.-t.'s, none fatal in itself, but cumulatively impressive. Very large land-animals usually have to use all their limbs as supports for their great weight. To this end the limbs are modified into massive columns with very short feet. To explain: a horse has very long feet. The "knees" of his forelegs are really his wrists, and his hocks are his ankles. This type of structure has been evolved independently in several widely separated phyla, such as the sauropods, the elephants, and the titanotheres—extinct relatives of the horse and the rhinoceros. That's convergent evolution again. A limb of this type is no good for manipulating things.

But then we remember the bipedal dinosaurs, some of which, like *Tyrannosaurus,* carried many tons around on their hind legs, leaving their forelegs free for use as arms. *Tyrannosaurus* failed to take advantage of this feature: his forelegs were reduced to mere useless vestiges, too short even to hold his food the way some of his ancestors had done.

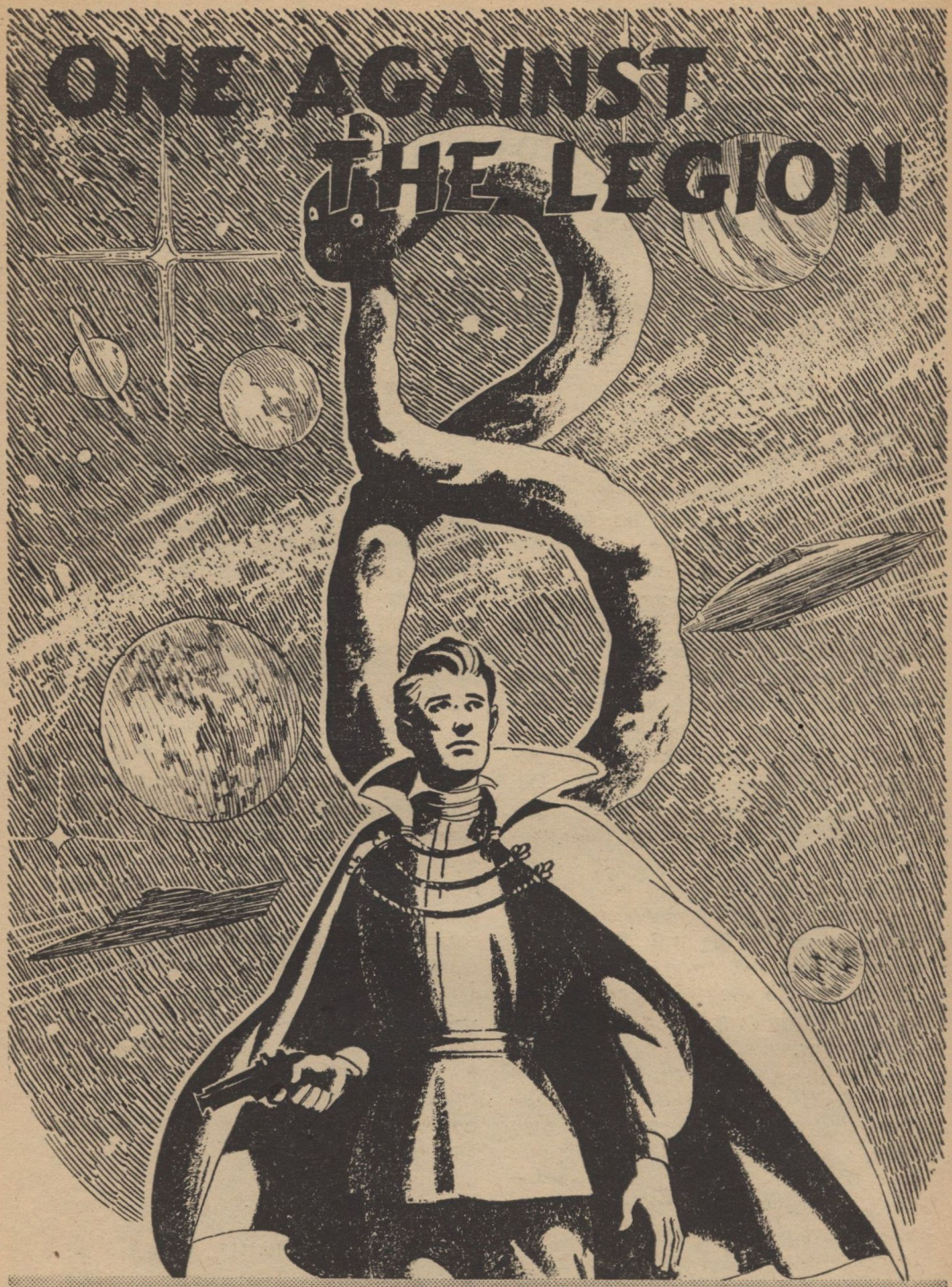
Another objection is the difficulty a beast the size of *Tyrannosaurus* would have in manipulating small objects. But we don't know how effective this drawback would be. There might be compensating advantages.

There is also the fact that great size calls for great perfection of the walking apparatus. And there seems to be a very rough inverse correlation between mechanical perfection and intelligence. Phyla that develop extreme mechanical perfection usually don't go in for brains as well. The dogs are less specialized killing-machines than their cousins the cats, and size for size they beat the cats in brains. The cats in turn are brainier —at least as far as we can judge from skulls—than their still more specialized relatives the late lamented saber-tooths. *We,* aside from our brains, our erect posture, and our loss of hair, tail, and jaw-power, are fairly primitive mammals.

If we must have a guess of some kind at the probable maximum size, mine would be that of the 1,600-pound Alaskan grizzly bear—or brown bear, all the same thing. But if anybody wants to go up to a ton or a ton and a half, I won't object.

So the design of our e.-t. shakes down to the following characteristics: an active multicellular land-animal with a weight between forty pounds and a ton, made of carbon compounds and operating on an oxidation-reduction metabolism. This leaves a lot to be decided in the matter of physical details. But that is another story.

TO BE CONCLUDED.



A GREAT SEQUEL TO "THE COMETEERS"

BY JACK WILLIAMSON

ONE AGAINST THE LEGION

Giles Habibula neatly picks himself as the Basilisk's victim!

By Jack Williamson

Synopsis of Part I.

"Unusual. Important. Indubitably dangerous."

Such, Jay Kalam, commander of the legion of space, warned big, bronzed young Captain Chan Derron, was the duty before him. That duty was to guard the great geodesic engineer, Dr. Max Elcroid, during the test of a new and mysterious instrument.

The experiment was performed on a lonely islet, in a locked, hidden underground chamber. Chan Derron stood watch, outside. Dr. Elcroid and his assistant failed to emerge. When the fleet came, the door was found surprisingly unlocked. The two men were dead inside—apparently killed by Chan's missing barytron blaster.

Convicted of the double murder, Chan was sentenced for life to the prison rock called Ebron, and tortured because he did not reveal a thing he did not know—the whereabouts of the unaccountably missing invention.

After two years of hell, Chan Derron escaped. His efforts to find safety, however—first within the system and then upon a new astronomical object he discovered, ten billion miles northward—were mocked by the Basilisk, a supercriminal who displays an uncanny mastery of space.

False clues planted by the Basilisk have convinced the legion that Derron is the criminal. When the Basilisk boasts that his next crime will take place on the New Moon, that great interplanetary resort is guarded with Hal Samdu's fleet, and a reward is offered for Chan Derron.

Mockingly warned by the Basilisk that he will be blamed for the outrage in the New Moon, Chan Derron braves the fleet and the guards to enter it, desperately seeking to trap the Basilisk. Entering the Casino in disguise, he meets a lovely girl, unknown to him, who recognizes him—and knows that his life is worth a quarter of a million dollars.

As midnight approaches, the three veteran legionnaires, Jay Kalam and Hal Samdu and Giles Habibula, wait in the Casino's famous Diamond Room, with Gaspar Hannas, owner of the New Moon. They recognize Chan Derron, at a table beside the girl, but delay his arrest.

Giles Habibula, meantime—who knew Gaspar Hannas at the notorious Blue Unicorn, on Venus, forty years before—plays at the no-limit tables. He wins two billion dollars. And then Jay Kalam tells him, at eighteen minutes to twelve, that it is the highest winner whom the Basilisk has promised to rob and murder at midnight.

VIII.

GILES HABIBULA began to tremble. His blunging middle quivered like a bag of jelly. Drops of sweat stood out on his furrowed yellow face, and ran swiftly together. His small eyes seemed to glaze.

His teeth chattered violently; and then, being false, in his distress they fell out on the floor.

"Ahuh!" he gasped. *"Yuh . . . whuh—"*

He began tearing furiously to get his winnings out of his pocket. Jay Kalam retrieved the teeth. Giles took them clattering into the cavern of his mouth, and cried piteously:

"Jay! Ah, Jay, why didn't you tell me? A poor, blind old man, tottering on the mortal brink of life, a creeping, famished wretch with no teeth of his own to chew his miserable crust—Jay, would you let old Giles thrust his neck into the very noose of death?"

"You've Hal's fleet to guard you," the commander sought to reassure him, "and ten thousand of the New Moon's police. We'll protect you, Giles."

"Aye!" An eager fighting glint lit the blue eyes of Hal Samdu. "We've set a trap for this Basilisk—and now you've baited it well, Giles, with your two billion dollars!"

"Ah, no!" sobbed Giles Habibula. "Old Giles will bait no traps—not with his poor old flesh!" He was staggering back to the table he had just quitted so triumphantly. "How long did you say, Jay?" he gasped. "Just fifteen blessed minutes—to lose two billion and twenty million mortal dollars!"

The croupier went white again, to see him returning, and clutched for support at the edge of the table.

"Hasten, man!" the shrill voice of Giles Habibula urged him. "Call for the bets and spin your ball! In life's mortal name, is this place a hall of chance—or the black Euthanasia Clinic?"

The croupier gulped and whispered hoarsely:

"Place your bets, gentlemen! Bets on the table!"

The leaden eyes of Giles Habibula were peering along the row of players.

"Some mortal fool has got to win," he croaked. His glance fell upon a little gray man, opposite. A thin, dried wisp of a man. His pale, anxious eyes, through heavy-lensed glasses, were peering at endless rows of notations in a small black book. His thin, nervous fingers were tapping at the keys of a compact, noiseless computing machine. But three blue chips remained before him on the board. Giles Habibula called to him: "Brother, do you want to win?"

The little man blinked at him in near-sighed bewilderment.

"Sir," came a shrill, piping voice, "I do! More than anything else in the world. I have been laboring twenty years—I have made fifty million calculations—endeavoring to perfect my system of play. I . . . I have three chips left."

"Forget your mortal system," wheezed Giles Habibula. "And play your three chips on one hundred and one."

The little man scratched his gray head uncertainly, and peered back at his little book and his calculating machine.

"But my system, sir, based on the permutations of numbers and the gravitational influence of the planets, my system—"

"Fool!" hissed a mousetrap-faced female beside him. "Play! Old blubberguts has got something! He just cleaned up a couple of billions."

She set a stack of her own chips on one hundred and one.

Giles blinked, and the croupier spun his ball.

THE LITTLE gray man looked at his machine, and put one chip on forty-nine. The fat yellow hands of Giles Habibula, handling the green certificates as if they had been incandescent metal, laid the stack of his winnings on the double zero.

"Two billion and twenty million," he told the chalk-faced croupier. And his voice dropped to a rasp of deadly menace. "And don't you move till that ball

stops. Don't take a mortal breath! I'll handle the capacity."

He looked back at the little gray man.

"On second thought, brother," he wheezed, "your forty-nine will win. Due to gravitational influences!" He thrust the green handle of his cane abruptly into the croupier's pasty face. "You stand still!"

The cane lifted, with a slow, deliberate sweep, and the ball clicked into the slot.

"Forty-nine is the winner!" With a sobbing cry of relief, the croupier snatched up the sheaf of bills from zero-zero. With a trembling wand, he raked in the other bets. He pushed a stack of a hundred chips to the little gray man.

The bleak-faced woman made some sound, very much under her breath, and abruptly departed.

"My system!" piped the frail little man, excitedly. "At last—after twenty years—it wins!"

His thin fingers recorded the play in his little black book. They tapped the silent keys of his machine. He peered at the dial, and then pushed the half stack of his chips back upon the number forty-nine.

The colorless eyes of Giles Habibula glittered at the croupier.

"Forty-nine," he predicted, "will win again."

The croupier licked his dry lips. His glazing eyes shot a despairing glance at Gaspar Hannas. He hoarsely called for bets, and spun the ball, and watched its clicking circle with a kind of white horror on his face.

And forty-nine won!

"My system!" The small gray man peered at the racks of chips pushed toward him. "For twenty years," he shrilled, "Dr. Abel Davian has been thought a visionary fool. And now—" His heavy lenses stared about the hushed, wondering table. "Now, sirs, I must be acknowledged a mathematical genius!"

And he began recording the play, in a frantic haste.

"Caution, brother," Giles Habibula wheezed at him. "This is a time for a mortal bit of moderation. Remember the B—"

"Hush, Habibula!"

The great white hand of Gaspar Hannas spun him around, ungently.

"Don't speak of the Basilisk! You'll ruin me, yet!"

Jay Kalam studied his chronometer again.

"Eleven minutes," he said. "We had better be looking for him—and keeping an eye on our Dr. Derrel!"

THEY MOVED away across the vast floor, Hal Samdu stalking impatiently ahead. Laboring and puffing, Giles Habibula fell behind. Sweat broke out again on his yellow face.

"In life's name!" he sobbed. "Jay, Hal, can't you wait for poor old Giles? Would you leave him alone—with the mortal Basilisk at his heels? Can't you feel the tensity of doom in the very air, aye, and see the stark print of fear on every mortal face?"

Jay Kalam had paused, and the old man snatched at his arm.

"Come, Jay!" he gasped. "For life's sake, let's make ready for the moment. Let's stand against the wall, Jay, and gather all our men about us, with blasters ready—"

"Shut up, Giles!" rapped Hal Samdu. "There's no danger, but to the winner. None, I think, if we surround this *Dr. Derrel—*"

"My mortal life!"

It was an apprehensive croak from Giles Habibula. Trembling, his arm was pointing at a table where the play had stopped. A tall man dressed in white was setting upon it some bulky object wrapped in brown canvas.

Giles Habibula stared anxiously, as he uncovered it. A square black box was revealed, with polished brass rods

projecting from the sides and the top of it. A little instrument board was wired to the box, and a set of phones that the man slipped on his head.

"Who is he?" Giles Habibula had caught the arm of Hannas. "In life's blessed name, what is that machine?" His thin voice quavered. "I don't like the look of such mortal strange machines—ah, no, not when we're dealing with such an unknown monster as the Basilisk!"

"That's only John Comaine," said the great voice of Gaspar Hannas. "We'll speak to him."

He led them to the man whose brains had conceived the New Moon. Comaine, in his white laboratory jacket, looked robust and athletic. His stiff blond hair stood on end. He had a square, stern mask of a face, with slightly protruding, emotionless blue eyes. He nodded to Gaspar Hannas, a stiff and uncordial greeting.

"Comaine," said Hannas, "this is Commander Kalam and his aids; they have come to hunt the Basilisk."

The glassy, bulging eyes looked at them briefly, coldly.

"Gentlemen," his voice was dry, metallic, inflectionless, "I am attacking the problem in my own way. I built the New Moon. I am going to defend it."

Giles Habibula was gaping at the black box.

"Ah, so, Dr. Comaine. And what is that?"

"The operations of the Basilisk," Comaine said briefly, "display the use of an unfamiliar scientific instrumentality. The first step, obviously, is to detect and analyze the forces used."

And he turned abruptly back to his instrument panel.

"Ah, so," wheezed Giles Habibula. "You are mortal right. And that is that!"

And they went on among the tables, watchfully scanning the thousands of players. An increasing tension charged the air. Play had almost stopped. A nervous hush was spreading, broken now and then by a voice too loud, by a laugh that jangled with unadmitted fear. Many who had come to watch the work of the Basilisk seemed to regret their early courage, and there was a steady little trickle of silent men and women toward the doors.

ABRUPTLY Giles Habibula stopped again.

"I know that man!" he puffed. "Aye, forty years ago, at the Blue Unicorn! He is Amo Brelekko!"

"Naturally you know him," rasped the great voice of Gaspar Hannas, "since you and he and I were three of a kind, in those old days."

"Ah, what's that?" Giles Habibula inflated himself, indignantly. "In life's name, Hannas, I'll not have you say three of a kind!" His fat lips made a sharp, startling sound, as if he had spat. "Neither you nor Amo the Eel ever did a mortal thing, but Giles could do it quicker and smoother and more silently, with precious less danger from the law!"

His leaden eyes went back to the tall man strolling toward them. Amo Brelekko was gaunt to the point of emaciation. His huge head was completely bald. Bushy black brows shaded his deep-set, brilliant dark eyes. A long hatchet nose accented the knifelike sharpness of his face. He now wore brilliant purple lounging pajamas, and a flaming yellow robe. A great diamond pinned his tunic, and the lean yellow claws of his fingers were glittering with rings.

"Amo the Eel!" whispered Giles Habibula. "You wouldn't know that forty mortal years had gone. He looks just the same. He had the swiftest hands I ever know—aye, besides my precious own!"

His pale eyes blinked shrewdly at the New Moon's master.

"What is he doing here, Hannas?

You couldn't let him play. He knows your mortal tricks as well as I do."

The white giant in black smiled his silly smile.

"Brelekko has been here since the New Moon was built," said Gaspar Hannas. "I offered him ten thousand dollars a day to play for the house. He refused. He said that he would prefer to take his money from the other side of the table.

"And he does. But he is more moderate than you were, Habibula. He limits his winnings scrupulously to ten thousand dollars a day. I don't regret his presence. He is a valuable advertisement for the New Moon."

"The Eel was but a youth when I knew him," said Giles Habibula. "But he showed a precious promise, in the quickness of his hands."

"Brelekko is a gifted man," agreed Gaspar Hannas. "He is a skilled amateur magician—sometimes he gives a special performance for our guests. His brain is as clever as his hands. He invented the game of hyper-chess, and none can beat him at it."

"I never tried," muttered Giles Habibula.

"His suite is equipped as an astrophysical laboratory," Hannas went on, "with an observatory dome outside, on the New Moon's hull. By avocation he is a brilliant physicist, by vocation the greatest gambler in the system—"

The leaden eye of Giles Habibula had begun to glitter.

"Except," Gaspar Hannas added very hastily, "of course, yourself."

His great white hand beckoned, and Amo Brelekko came to meet them. When his dark eyes found the waddling old man in gray, however, he stopped abruptly. Gems glittered in a sudden arc, as his lean hand flashed toward his armpit.

But the thick cane of Giles Habibula was first. It snapped up level with the gaunt body of Amo Brelekko, and his yellow hand tensed on the head.

"Still, Brelekko!" His thin voice rang cold with menace. "Or I'll burn you in two." As the jeweled hand dropped, his voice softened. "Mortal me, Brelekko," he wheezed, "after forty years, can't we forget?"

"I'll never forget, Habibula." The speech of Brelekko was a voiceless husking. "Not in forty centuries!"

"Then you had best restrain yourself, Amo," advised Giles Habibula, grimly. "At least until midnight has passed."

The fleshless, cadaverous face of the gambler made an unpleasant grimace.

"So you are here to hunt the Basilisk, Habibula?" his rasping whisper asked. "There is an ancient Terrestrial proverb, 'Set a thief to catch a thief.'" His laugh was also queerly muted, a kind of chuckling hiss. "But I think even that will fail. For the Basilisk is a better thief than you ever were, Habibula."

Giles Habibula caught a choking breath, and the cane lifted swiftly. But Amo Brelekko, with a mocking little gesture of his thin jeweled hand, had turned toward a distant table, where there was a little stir of sudden excitement.

"We'll soon know," he whispered. "For yonder is the winner, I believe—the man in danger. And midnight is almost at hand."

LIKE A YELLOW skeleton stalking, he hurried toward the table. The three legionnaires and Gaspar Hannas hastened after him. The most of the players, when they came to the table, had drawn a few paces back—out of apprehensive respect, it seemed, for the ominous promise of the Basilisk—so that only a few were left about the table, at the center of a hushed, whispering ring of spectators.

Most of those few yet at the table were the plain-clothes men of the legion. But the big pale man who gave the

name of Charles Derrel had pushed through to join them, with the tall blond beauty at his side. Amo Brelekko was standing beside the croupier, peering through a monocle at the wheel. The engineer in white, John Comaine, had moved his mysterious equipment to the end of the table; the phones were on his head, and he was fussing with the instrument panel.

The only actual player at the table—and, obviously, the focus of all the expectant strain that filled that hushed, watching circle—was the little gray man, Abel Davian.

His stacks of chips were taller, now. And he was quivering with elation. His heavy spectacles were awry, and his shrunken skin, beneath the garish atomic lights, was bright with sweat. His tunic was torn open at the throat. Feverishly he noted the last play in his little black book, and tapped at his silent calculator. His thin, trembling hand pushed out another bet.

Giles Habibula had stopped, panting apprehensively, in the circle of tense onlookers. But his three companions pushed forward to the table, and the little man peered up at them. His nearsighted eyes blinked in recognition.

"My mathematical theories are fully vindicated, gentlemen," he piped. "My system has won twenty million dollars—a million for every year of my toil!" He paused to draw in the chips pushed toward him. "That is all I wanted. I'm going to quit."

He asked the croupier for an empty moneybag. His trembling hands began stuffing it with his winnings. Blue chips, and the glittering diamond ones worth ten times as much. The gold-colored New Moon scrip. And crisp certificates of the Green Hall.

Jay Kalam snatched a glance at his chronometer, and made an imperative gesture to the alert legionnaires about him.

"Five seconds!" he whispered. "Guard this man."

Little Abel Davian picked up the bag of his winnings, and his calculator, and his little black book, and shuffled wearily away from the table. Passing the tall stranger, he paused to mop his perspiring face. His head jerked against the handkerchief, oddly. He made a stiff little gesture of farewell.

"Good-by," he shrilled. "For I'm going to leave the New Moon—"

Jaya Kalam stiffened where he stood, and caught his breath.

His ears heard a most peculiar noise. It was a deep purring hum. It was like the pur of a monstrous jungle cat, the thought flashed to him, in its suggestion of ominous and ruthless power. The even rhythm of it was mechanical. And it had an uncanny penetration—it throbbed through all his body, made his bones tingle, set a queer dull ache in his head, set his teeth to chattering.

And Abel Davian—*flickered!* Exactly, the commander briefly thought, as if some perfectly transparent curtain had dropped between them. And his thin, stooped little body seemed for an instantly queerly frozen, like a motion picture when the projector has stopped.

And then Abel Davian was gone.

Even in that stunned and breathless instant, Jay Kalam was aware of the crackle of discharged electricity, of the tingling of his skin. He knew that a sudden force pushed him violently toward the spot where Abel Davian had been, instantly tugged him as violently back.

And then, still swaying and sick to his heart with a cold nausea of fear, Jay Kalam ran his hand before staring, utterly unbelieving eyes.

For there beside the table, in the exact spot from which the little man had been so strangely snatched away, was something else! Something—

Monstrous!

IX.

CHAN DERRON, when the blond girl greeted him by name at the Casino's resplendent entrance, stood for an instant shocked and cold. Then, looking into her shining violet eyes, he let himself respond to the glory of her smile, and he returned her warm hand's pressure.

"Can we talk a moment?" he said, and nodded aside from the busy portal.

"But come with me, inside," she said —and her voice was a magical golden song that rang in his heart. "I've a table reserved for us in the grill beside the Diamond Room. We can talk as we dine. And then—"

The music of her voice missed a note, and through the violet depths of her eyes flashed something black and cold as transgalactic space.

"Then," she said softly, and the radiance of her eager smile set a pain to throbbing in his heart, "we shall play."

"Wait, please!" Chan Derron caught his breath, and tried to still the wild pulse hammering in his ears. He made his eyes look for a moment away from the girl's disturbing beauty, and mastered his face and his voice. He turned back to her.

"I'm sorry," he said. "Very sorry—for you are the most beautiful person that I have ever seen. But you have mistaken my identity. I am Dr. Charles Derrel. Here from Venus, en route back to Earth. I'm sorry, but we've never met before. And I don't know this—did you say Chan Derron?"

Her fine proud head shook a little, and the lustrous platinum hair shimmered in the changing light from the immense, jewellike columns of the Casino. There was something subtly mocking in her violet eyes, and Chan noticed for the first time that they were very slightly tilted.

"I could not mistake your identity," she said softly. "And if you don't know Chan Derron, I'll refresh your memory."

Her slim, quick hands opened a white bag, and allowed him a brief but sufficient glimpse of his own features, beneath the screaming type that offered a quarter of a million dollars in reward. The bag snapped shut, and her white smile dazzled him.

"Now, Dr. Charles," she asked, "shall we dine?"

Something, far beyond the light, inviting music of her voice, was hard as the great white jewel at her throat, cold as a planet whose sun is dead. Chan Derron tried to conceal the tiny shudder that ran through his big body.

"Whatever you say, my dear," he told her.

Inside the massive, gold-rimmed portal, they had to show their reservation checks. Chan glimpsed the girl's. The name on it was Vanya Eloyan. Residence, Thule. But it was a yellow temporary check, like his own.

IN THE dining room, which occupied a triangular space between two of the radiating halls, Chan seated the girl at a secluded, fern-hidden table. She declined champagne, and so, cautiously, did he.

"Vanya Eloyan," he said softly, relishthe name. "Of Thule. That plantetoid is a far, cold home for such a girl as you." He looked up at her white, dynamic loveliness. "But I think that you are a girl of Earth, Vanya. I've never seen a colonial quite so beautiful. Your accent, however, shows the mark of the Martian universities. You were educated there, I believe. In science, I should say. And music. Am I right?"

The white perfection of her face was very grave. It was fixed, suddenly, with a solemnity of purpose almost tragic. And yet the sheer beauty of it kept an ache in Chan's throat.

"I prefer not to speak of myself." Her voice, for all its music, was cold as the Sun of Neptune. "I came to meet you

here, Chan Derron, to ask you a question.". She leaned a little forward, her splendid figure tense; and in her violet eyes lit a fire bright and terrible. *"What did you do with Dr. Eleroid's invention?"*

All the blood ran out of Chan Derron's face, leaving it the ghastly gray-white of the pigment he had used. A cold blade cleft his heart. Icy, strangling hands stopped his breath. The strength ebbed out of him. His big body sagged toward the table.

In the prison on Ebron he had heard that question ten thousand times, until the very syllables brought back those years of torture. He had been fighting for two years to escape it. It was a little time before the dryness of his throat would let him speak, and then he said:

"I didn't kill Dr. Eleroid. I didn't take his invention. My conviction was unjust. I was, and am, the victim of something—someone—monstrous! Believe me, Vanya."

Her eyes glinted with the cold of a polar dusk.

"I don't believe you, Chan Derron," her low voice range with a deadly power. "And you will not escape until I know what you have done—what you are doing—with Dr. Eleroid's secret."

The desperate, ruthless intensity of her ready poise and her searching face made her seem to Chan the most beautiful and the most terrible thing he had ever seen. And suddenly he was startled by some mocking familiarity.

"Remember, Chan Derron," her cold voice warned him, "with two words I can end your life tonight—and end the amazing career of the Basilisk!"

Chan Derron drew a long slow breath, and settled back in his chair. He was staring at the figure of white loveliness across the table. He stared while a silent waiter brought their food, and silently departed. And the thing he saw was more alarming than her icy threat.

For the make-up on her perfect face dissolved and shifted. Her violet eyes turned a clear ice-green. The platinum

splendor of her hair became a glory of red-lit mahogany. Yes, indeed, he knew her face!

He had studied every feature of it, for lonely hours, on the picture beside his own on the bulkhead of the *Phantom Atom*. This glorious and deadly being was no woman! She was Luroa; last survivor of the androids; brilliant, criminal synthetic monster. The price on her life matched that on his own.

Chan Derron smiled, gently, and eased the dark glasses on his face.

"You know two words," he whispered softly. "But I know one—Luroa."

There was a flicker of white tension on her face, he thought. The flash of something dark and deadly in the deep pools of her eyes. But in an instant she was smiling at him—radiantly.

The food, Dr. Charles," she said. "We're letting it grow cold. Let us eat, for we must be in the Diamond Room before midnight!"

WHEN THEY were in the gaming room, the girl bought a stack of chips—displaying a sheaf of green certificates that, Chan thought, spoke amply of the sinister skills of Luroa. They played, he placing the chips at her direction. And won. Perhaps, Chan thought—he had few illusions about the rôle of chance at the New Moon's table—because the magnet of her beauty always crowded the table where she played.

Her violet eyes were watching him very closely he knew, and all that happened about them, and the minutes that fled. She was waiting, he realized, for midnight—and for him to betray himself as the Basilisk.

"Vanya," he whispered once, when they had a moment alone, "I came here only to hunt this criminal. If you'll let me—"

"Wait," she said inexorably, "till midnight."

When the three legionnaires came upon them, Chan Derron knew the commander and Hal Samdu at once. Even in mufti, they were unmistakable to any man who had served in the legion. For a little time he put hope in his disguise—fervidly regretting that he had not been six inches shorter.

The return of his check and keys, however, by Jay Kalam, convinced him that he had been recognized—that the little fat man's spectacular maneuvers had been no more than an elaborate accompaniment to the picking of his pocket.

It surprised him that the girl spoke so promptly in his defense. Sense of her surpassing beauty kept rising above his fear of her—above the cold instinctive horror of the android. When the commander had gone, he turned to her with a little smile of relief and gratitude.

"Thank you, Vanya."

Her smile of response was breath-taking—but all intended, he swiftly realized, for the spectators. For her golden voice, dropped softer than a whisper, yet pitilessly cold, rang ominouly at his ear:

"No thanks are due me, Chan Derron. Kalam and Samdu and old Habibula know you as well as I do—and my identification meant nothing to them. They are just waiting—as I am—for midnight."

And midnight came.

The girl, as the moment stalked upon them, had gripped Chan's arm. Her small fingers sank desperately into his flesh—stronger, he thought, than most men's. And her keen violet eyes were watching every movement of his, he knew, as sharply as he watched the promised victim of the Basilisk—gray, trembling little Abel Davian.

Her other hand, he marked, and wondered at it, was toying oddly with the great white jewel at her throat. What manner of stone, he was asking himself in that final moment, was this huge gem that had the prismatic sheen and the intricate hexagonal perfection of a great snowflake?

THE THIN little man, trembling with the burden of his winnings, paused and sneezed. And then Chan Derron heard that hideous, feral purring. He saw Abel Davian flicker, grow queerly rigid—and saw that he was gone. He felt a breath of dank, ice-cold air. He was flung toward the spot where Davian had been, was dragged incontinently back.

Then—hardly aware that he was strangling to a whiff of some choking, acrid gas—he was staring with bewildered and incredulous eyes at the monstrous thing that stood in Davian's place.

Monstrous—it was like nothing men had found in all the System.

Standing on three thin, swaying, rubbery-looking legs, it reared twelve feet high. Queerly teardrop-shaped, its body was covered with close-set, green-black scales. Three huge eyes, of a dull and sinister crimson, glared from its armored head. It had a disproportionately large, jet-black beak, yawning open to reveal multiple rows of saber-like teeth. An unpleasant fringe of long green serpentine tentacles hung under the beak.

A greenish slime was dripping from that fearful body to the polished floor, exactly, Chan thought, as if it had just that instant been snatched out of the muck of some primordial jungle. Beneath the slime, its dark scales had an odd, metallic glint. And there was that strangling, pungent reek, which Chan slowly recognized to be chlorine.

For a little time it stood almost motionless, twisting that frightful, long-beaked head, so that those three enormous red eyes, which looked in three separate directions, could survey all the circle of puny humans about it.

A queer strained hush had fallen on the Diamond Room. For a moment there was not even a scream. Then those nearer, choked and blinded with the breath of chlorine that had come with the creature, began to stumble uncertainly back. The first hysterical laugh, turned into a thin, sobbing scream. And the hush became an insane stampede.

But already the thing had moved. Three wings were abruptly extended from its armored back. Queerly, they *unrolled:* They were translucently green, and delicately ribbed with darker emerald. One on each side and the third, taillike, behind, they raised and fell, one by one, experimentally, and then became a blur of motion.

Out of that fearful black beak came an appalling bellow. Reverberating against the lofty vault of the Diamond Room, dripping and clotted with uncanny menace, it gave wings to the fugitive thousands.

And the creature itself, with an ungainly but amazing swiftness, ran forward on the three swaying limbs. Its wings made a mounting thunder of sound, and the wind rushing from them was choking with chlorine.

"Back, Vanya!" gasped Chan.

He was pulling the girl from the creature's path, snatching for the barytron blaster under his cloak. But she twisted away from him, with an easy, pantherine strength. Her cold voice whipped back at him, deadly:

"So you did it—*Basilisk!*"

Chan leaped after her. But the great wing struck his head, crushed him down. Falling, he glimpsed the girl standing in the monster's path. Both her hands, he saw, were lifted to her strange white pendant.

Then the green tentacles, squirming snakelike beneath that beak, snatched her up. The thing lifted with her, above the expanding ring of panic-stricken fugitives, and flew with her swiftly down the hall.

"Get him!" It was the great voice of Hal Samdu, roaring vainly out against the shrieking tumult. "Get Chan Derron!"

BLIND AND coughing from the chlorine, the giant was staggering about, blinking his eyes, waving a big glittering barytron blaster. Jay Kalam, beside him, strangled and voiceless, was trying to call to the plain-clothes men.

"Aye," wheezed Giles Habibula from beneath a table. "And get the mortal monster!"

Gaspar Hannas was choking a hoarse call to his police.

"Half a million!" he bellowed. "To the man who gets Chan Derron!"

Stunned dismay and poison gas, Chan realized, had given him a bare few seconds to attempt escape. And, strapped to his body beneath the green cloak, he had the means—the compact geopeller unit from his spacesuit. The control cable ran down his sleeve, and he gripped the heavy little spindle in his hand.

A swift pressure on it—and he rose silently from the midst of his enemies. Flying high beneath the vault of the Diamond Room, he soared after the monster and the girl.

White, silent barytron bolts stabbed after him. Concrete exploded from the painted vault, rained down into the panic on the floor. He breathed the sharpness of ozone, and felt one faint shock.

But the geopeller, for all its compactness, was swift—swift enough for interplanetary flight. Chan pursued a darting zigzag. Seconds, only, had gone, when he came to the end of the long Diamond Room. But the monster, with the girl, had already vanished.

The way of their going was plain. The alien creature had scorned to use the wide doorway beneath. A ragged opening yawned in the top of the vault. Chan twisted the spindle in his hand. The geopeller flung him up through it.

And his brain, refreshed by the cool rushing wind of his flight, made a swift decision. This moment—when he was free and in the air, when the monster was creating an unwitting diversion—was obviously his chance to escape. And a faintness of dread impelled him to flight, for the girl's accusation and the encounter with Jay Kalam had brought back all the horror of the Devil's Rock.

But he hadn't come here to escape. He had come to hunt the Basilisk. And the monster was the one visible clue to the identity and the methods of that amazing criminal. A little shudder tensed his straight-extended, flying body. But he knew that he must follow the monster.

The girl, he tried to tell himself, didn't matter. The pitiless synthetic brain of Luroa, he knew, was a greater danger to him than all the legion. It would be better if the monster destroyed her. Yet, for all that, thought of Vanya Eloyan spurred him to a frantic haste.

Beyond the hole in the massive wall—which could only have been torn, he thought, by a barytron bolt or some force equally powerful, and which, therefore, meant that the monster was armed with something far more formidable than tentacles and fangs—he plunged into the corridors of the New Moon's museum.

The monster and the girl were gone from sight. Far down one hall a little cluster of people were running frantically. Beside a glass case stood one of the attendants, with a yellow crescent on his uniform. Chan dropped out of the air beside him.

"Which way?" he demanded.

The man stood wooden, glassy-eyed. His arms made a sudden defensive gesture, against Chan—although the geopeller had been used a little in sports, it was still new enough so that a flying, wingless man must have seemed almost as startling as the monster.

Chan shook the attendant. "Which way did it take her?"

"It couldn't be!" the man sobbed. "There isn't such a thing!" His eyes came into focus again, and he stared at Chan's face as if doubting its humanity. "A thing carrying a woman?" he whispered. "It went on up, into the un-

finished spaces. That way!"

He pointed—and then bent suddenly, very sick.

TWISTING and squeezing the spindle, Chan darted upward again. Wind shrieked in his ears, tore at his cloak. He found the shattered hole in the ceiling, plunged through into an incompleted part of the New Moon's structure.

Above bare floors, naked beams and girders and cables soared upward into gulfs of darkness. Unshaded atomic lights burned here and there, like stars in a metal universe. They cast blue, fantastic shadows. It was thousands of feet, beyond the webs of metal, to the black curving metal of the New Moon's hull.

Chan Derron peered, bewildered for a moment, into that blue mysterious chasm of sinister shadows and spidery metal. His right hand dragged the barytron blaster from beneath his cloak. Then he heard the monster.

The awesome bellow reverberated weirdly through the maze of empty steel, it rolled thunderously back from the metal hull. But it gave some clue to direction. The geopeller flung Chan upward again. And at last, on a high platform that the builder had used, he came upon the creature and the girl.

A far blue light cast a grotesque web of black shadows across the scene. The girl lay supine. The green-black horror of the monster crouched over her, hideous beak yawning wide. The serpentine tentacles were writhing about her throat.

The geopeller hurled Chan forward. The barytron blaster flashed in his extended right hand. The first white bolt struck the dark-scaled body, with a flare of green incandescence—without harm, it seemed. And the green tentacles flung up a weapon.

A barytron blaster of the newest legion design, identical with his own!

The merest fraction of its energy could have electrocuted—exploded—his undefended body. But his second bolt, into the monster's central crimson eye, took instant effect. The blaster fell. Queerly stiffened, the creature toppled toward the girl.

Ignoring a voice of fearful protest in his heart, Chan sent himself forward. The same arm that held the blaster slipped under the girl. The geopeller lifted them both. The monster came crashing down behind them. The diaphanous green wings, when it struck, abruptly unrolled. They remained rigidly extended, and the thing did not move again. Chan dropped, beside it, and set the breathless girl upon her feet.

Her lithe body had been vibrantly warm in his arms. There was subtle intoxication in the perfume of her platinum hair. The radiance of her white smile made him glad, for a moment, that he had saved her.

"Thank you"—some husky magic in her breathless voice set his heart to racing—"Chan!"

Her violet eyes slowly closed, and her scarlet lips swayed toward his. And then, with an unexpected pantherine quickness, she was gone from his arms. A clever, numbing blow from her elbow had struck some nerve center in his neck. A clever, savage strength had wrested the blaster out of his hand.

He swayed, dazedly. Here, far from the gravity plates in the "bottom" of the New Moon's hull, their attraction was somewhat decreased, and it required a little time for muscles to adjust themselves to the lessened strains.

When he recovered, the girl was already backing alertly away from him, covering him with his own weapon.

"Well, Mr. Basilisk!" her soft voice mocked him. "Let's see you get away this time!"

Chan caught his breath. The blue darkness and the shadowy strands of

steel spun about him. He had foreseen this danger from the girl—and yet the very peril of her beauty made it all incredible.

His hand tightened on the spindle of the geopeller. Small chance of distancing the bolt of barytrons, he knew. But the power of the little unit could hurl his body against her—

"Still, Chan Derron!" her voice rang sharply. "Open your hand." The blaster gestured alertly.

His fingers relaxed. He tried, hopelessly, to protest:

"Vanya, you *can't* believe that I'm the Basilisk. For, all the time, you were there at my side—"

"Silence!" The bright weapon lifted, imperatively. "I was there," she said, "close enough to feel the mechanisms strapped to your body, Derron. To feel the wires in your sleeve."

Narrowed, her violet eyes had a deadly glint.

"I had you then, Derron—until you sent your little pet to carry me away.

The blast of Chan's weapon seemed to leave the Thing unhurt—and in the monster's tentacle was a duplicate of Chan's own deadly barytron weapon.

Now I've got you again—and you won't escape!" He wondered at the fingers of her left hand, lifted to that strange white jewel at her throat. "But I'll give you one last chance."

He saw the tension in her hand, saw the ruthless purpose behind the white perfect mask of her face. Cold as sleet, her voice whipped at him:

"What did you do with Dr. Eleroid's invention?"

Sick, helpless, he shook his head.

"Where is the machine you control with the instruments on your body—"

He knew she was going to fire, when he didn't answer. He could hurl himself at her with the geopeller. Two deaths, instead of one. But her pitiless beauty—

That monstrous pur came suddesly. The girl and everything beyond flickered abruptly, as if a wall of vitrilith had dropped between. He saw her hand

stiffen on the blaster, saw the white bolt's flash.

The last thing he saw was her white face, with grim suspicion changed to amazed and hateful certainty. Her image dissolved in a chasm of starless darkness. And Chan Derron was hurled into black and airless cold.

X.

"YOU SAY it's dead?" quavered Giles Habibula. "Jay, you're sure the fearful thing is dead?"

High in the blue dim web of shadows and metal beneath the New Moon's shell, the grotesque monstrosity sprawled stiffly on the bare platform. Jay Kalam and Hal Samdu and Gaspar Hannas were staring down at it, wonderingly. Giles Habibula hung apprehensively back near the elevator that had brought them up.

"Quite dead," Jay Kalam assured him. "Chan Derron evidently beat us to it. Who would have guessed he had a geopeller unit under his cloak? And then got away—with the girl!"

"Got away!" It was a frightened groan, from the gigantic, black-clad master of the New Moon. His foolish smile was ludicrously pathetic. "And all our guests know he did! There's a panic at the docks! Every vessel going out is already booked to capacity. In twenty-four hours there won't be a visitor in the New Moon—and not many of our own employees—unless the Basilisk is caught!"

The great white hands of Hannas clenched, impotently, as: "The Basilisk has ruined me, commander!" he groaned. "Or Chan Derron has. Already."

"Keep your men after him." Jay Kalam's gesture swept the dusky labyrinth of shadow-clotted steel. "He could be here—anywhere. With that woman—" His dark brow furrowed. "There was something about that woman—you observed her, Hal?"

"Aye, Jay," rumbled Hal Samdu. "She was beautiful—too beautiful for any good! She had that destroying beauty that belonged to those evil androids of Eldo Arrynu."

"Android!" Jay Kalam started at the word. "She could be! She could be Luroa—Stephen Orco's last sinister sister!" He set his lean fingers deliberately tip to tip. "The New Moon would be her natural hunting ground, and Chan Derron the sort of confederate she would seek. But she didn't look like—"

"Ah, Jay, but she did!" protested Giles Habibula, plaintively. "'Twas mortal evident! The hair and the eyes were changed, of course. And make-up cunningly used, to alter the proportions of her blessed face—ah, Jay, 'twas a lovely one! But all its precious features were identical with those on the mortal bill of reward!"

Jay Kalam spun on him.

"Why didn't you speak?"

Lifting his cane defensively, Giles Habibula stumbled apprehensively back.

"Jay, Jay," he whined plaintively, "don't be too mortal severe on a poor old soldier of the legion." He sighed heavily, and one fat yellow hand clutched at his heart. "Giles is an old, old man. His eyes are blurred and dim. But still he can relish the blessed sight of beauty, Jay. And that girl was too beautiful to be stood before your blaster squad. Ah, so, she was a blessed dream!"

"If you were any other man in the legion, Giles, you'd stand before a blaster squad yourself!"

The commander turned decisively back to Gaspar Hannas.

"Remind your police," he said, "that this android is worth two hundred and fifty thousand dollars. That makes three quarters of a million, for the two."

"I'll make it a millions dollars, commander," the white giant gasped wildly, "for the two! To save the New Moon . . . I'll do anything!"

He stumbled into the elevator tube.

JAY KALAM was rubbing reflectively at his lean jaw.

"Luroa might stand beside Derron on our suspect list," he said slowly. "We know that the brain of the Basilisk is clever, utterly ruthless, and superbly trained in science—and the brain of the android has those qualities in full measure. Luroa is either the Basilisk, or his confederate—or else she came here to snatch his prize away!"

He turned methodically to the rigid thing that Chan Derron had slain. Hal Samdu was already playing his light tube over it; Giles Habibula was prodding rather fearfully at its armored body with his cane.

"Ah, such a mortal horror!" the old man wheezed. "And it came out of nothing! To shatter the wretched nerves of a poor old soldier—"

"It came from somewhere," said Jay Kalam, gravely. "And it brings a new complexity into the situation. It's no native of the System. And like nothing we met on Yarkand, or in the comet. It means—"

"Jay!" It was an astonished gasp, from Giles Habibula. "Jay, look here!" The prodding cane trembled in his hand. "This mortal thing was never alive!"

"What's that?"

"See," the old man wheezed. "The scales of it are metal, fastened on with mortal rivets. The wings are neither flesh nor feathers—they're blessed *cellulite*. It's no muscles that made them beat, but this rotating shaft. These serpentine tentacles, that raped the poor lass away, are all of metal disks and rubber and wire. And the fearsome eyes have lenses of vitrilith.

"Jay, the thing's a mortal robot!"

"So it is, Giles." He bent over it. "And an illegal one, apparently. May I have your light, Hal?"

He peered into one of the huge, glassy orbs, felt the frail-seeming elastic stuff of the wings, inspected beak and tentacles and limbs, studied the patch of scorched metal scales, the fused pit where the cen-

tral eye had been.

At last he stood up, decisively, and returned the light tube.

"Ah, Jay," inquired Giles Habibula, "what do you discover?"

"A good deal," said the commander, gravely. "A good many inferences are immediately obvious. A thorough scientific investigation will check them, and doubtless suggest as many others."

He turned to Hal Samdu.

"Hal, you take charge of this. Send to Rocky Mountain Base at once for a crew of research technicians—get as many men as posible who were with us on the comet expedition—and have them disassemble this machine."

His lean hand gestured at the stiff monstrous body.

"Make a thorough microscopic, chemical, bacteriological, and spectrographic study of surface specimens and the material of every part. Photograph every part, before and after removal, under ultra-violet light. Compare it with the illicit robots in the legion museum. Make — But your crew will know what to do. Tell them to neglect no possible source of information—for this thing is our one tangible clue to the methods and the headquarters of the Basilisk.

"Have your men write up a complete report of what you find, and all possible deduction as to where this machine was built, by whom, for what purpose, and how it could have come to the New Moon. One word more—guard the robot and your results with the utmost care!"

"Yes, commander." Hal Samdu saluted, eagerly, and a joyous smile lit his big, ugly face. "Aye, and it's good to have something really to do, Jay, at last!"

And he stepped after Hannas into the elevator beam.

"NOW, GILES," the commander said, "there are three men that I must learn more about. I know the overwhelming weight of evidence that Chan Derron is our Basilisk—perhaps with the android's complicity. But, in a case so grave, we can't afford to overlook the bare possibility that our chief enemy is another. Admitting that the Basilisk must have a brilliant, pitiless, and scientific mind, there were three others present in the Diamond Room who might possibly be suspects."

"Eh, Jay?" The small fishy eyes of Giles Habibula blinked. "Who?"

"The engineer," began Jay Kalam, "John Comaine—"

"Ah, so," agreed Giles Habibula. "I didn't like the look of his mysterious box. And the others?"

"The gambler, Brelekko," said the commander. "And Hannas, himself."

"Hannas! And Brelekko?" The old man nodded. "Ah, so, I guess all three fit your classification. I know less of this Comaine. But if two men ever were ravening wolves, Jay, they were Hannas and Brelekko!"

"You knew them, Giles. Were they always friends, as now?"

"Friends, Jay!" The leaden eyes peered at him. "Ah, Jay, they were mortal bitter enemies as ever fought—the three of us were against each other. Ah, so! And if any of us had been less a man than he was, the others would have picked his blessed bones!"

"Tell me about it, Giles."

"It was forty years ago, and more. Jay." Leaning on the cane, he heaved to a sorrowful sigh. "When Giles was yet a man—aye, and a warrior, Jay!—not the miserable, shattered, dying old soldier before you now. He was back on Venus, on furlough from the legion—"

"Furlough, Giles?" inquired the grave commander. "For five years?"

Giles Habibula sucked in his breath, indignantly.

"The charges of desertion were never proven, Jay," he wheezed. "Oh, 'twas but a mortal wicked plot of my enemies,

to wreck the career of a loyal legionnaire—"

"Never proven," put in Jay Kalam, solemnly, "because all the documents in the case mysteriously vanished from the files of the legion."

"I know nothing of that, sir!" The fishy eyes blinked. "Jay, Jay—" A bitter sob. "If you've nothing better to do than turn up all the malicious lies that were invented by his enemies to ruin the bravest soldier that ever risked his life to save the blessed System—ah, then, Jay—"

His thin voice broke, piteously.

"Forget it, Giles." A faint twinkle lit the dark eyes of Jay Kalam. "And tell me what happened on Venus."

"Ah, thank you, Jay," wheezed the old man, gratefully. "You were never one to exhume the mortal skeleton of the past, to haunt a poor old soldier with!"

HE BALANCED himself on the cane.

"I went back to the Blue Unicorn, Jay. It was on a little rocky island off New Chicago. The wildest place—and the richest place—in all the blessed System. But it was a woman that brought me back, Jay."

He sighed, and his colorless eyes looked far away into the New Moon's darkness.

"Ah, Jay, such a woman as you wouldn't find in all the whole System today—not unless you picked upon the android Luroa. Ah, no other could be so beautiful, or so quick, or so brave as she was—Ethyra Coran."

He gulped, and his thin voice trembled.

"The three of us loved her, Jay. Ah, so, every man on Venus was mad with her mortal beauty—but we three were better than all the rest. We knew that the matter lay between us. And, for her precious sake, we had to pretend a sort of friendship.

"Amo Brelekko was just off the Jovian liners. He wasn't using that name, then. Or the one he had used on the liners—for one ruined man had killed himself, and another had been murdered. But he was made of money. He was only a callow youth, then. But already he had a skill—none but I could ever win from him, at any game. He had a voice, then. And the same gaudy dress and glitter of jewels that he wears today. He had a gentle, flattering way with women. Aye, Jay, many a poor lass had given him her soul, and perished for it.

"Gaspar Hannas had come from none knew where. He was known then as Pedro the Shark. There were a thousand whispers about his past, but he had a different face then—and none who had seen it cared to ask the truth. From wherever he came, he had brought a fortune with him, and he found more of the Blue Unicorn. Money and blood—ah, Jay, I've seen sights that an old man should forget. But I've made it plain that Gaspar Hannas was mortal grim. Precious few lasses would have dared to refuse him. Ah, but Ethyra Coran had a courage to match her beauty and her wit. Ah, so, and precious few men would have cared to be the rival of Pedro the Shark! But that was in the old days, Jay, when old Giles was still a man."

The old man's eyes chanced to fall again upon the robot monster on the floor, and he started back apprehensively, as if he had not seen it before.

"Ah, the fearful horror! . . . I could make a long story of it, Jay. Aye, a story of cunning and passion and death that 'twould make your blessed blood congeal to hear. For the Shark and the Eel were ruthless feral beasts, and I—you know that Giles was ever honest and straightforward, Jay, aye, and simple as a precious child. I had to grapple for their fearful weapons, to hold my own. To make the story short, Jay—"

He paused a little, and a happy smile seamed his round yellow face.

"I got the girl—aye, and a mortal lovely prize she was!"

His smile twisted into a triumphant grin.

"As for Hannas and Brelekko, why, each of them, Jay—through a neat little device of my own—blamed his defeat upon the other. Ah, so, they became mortal enemies indeed! But the quickness and the craft of Brelekko matched the brutish strength and the ruthless courage of Hannas, and each mailed to destroy the other."

"And you think they are still," the grave commander asked, "enemies?"

"Mortal enemies," insisted Giles Habibula. "Could they be friends? When Brelekko must be madly jealous of the rise of Hannas to wealth and power, in his New Moon. When Hannas—aye, and justly—must hate Brelekko for knowing his past and his tricks, for hanging on him like a leech, and winning at his tables.

"Ah, so, Jay, in either of them—you have brains enough—and mortal evil enough—to make your Basilisk."

"Possibly," admitted Jay Kalam. "Though there's not a shred of evidence, except against Chan Derron. We'll see them again, below."

WHEN Hal Samdu had returned, with a guard of legionnaires, to take charge of the robot for his crew of scientists, they went down again to the luxurious suite that Gaspar Hannas had placed at their disposal. The commander sent for Amo Brelekko.

Yellow and almost skeletal, strutting in his gaudy silks, great jewels glittering, the gambler made a fantastic figure. The insolence of his swagger, Jay Kalam thought, was put on to cover a deep unease. His dark eyes shot an insanely malicious look at Giles Habibula.

"Brelekko," asked the grave commander, "a clever man, on the spot from the beginning, intimately acquainted with the persons involved, what is your opinion about the Basilisk?"

The hawk-face remained a bleak tense mask, as:

"Oviously the criminal must be an able scientist," the voiceless whisper of the gambler replied. "Obviously, he knows the New Moon intimately. Obviously, also, he dislikes Gaspar Hannas. I know one man, commander, who fits those conditions."

"So?" wheezed Giles Habibula. "Besides yourself?"

The dark unblinking eyes darted at him, venomously.

"Who is that" Jay Kalam prompted.

"The man who built the New Moon," husked Brelekko. "John Comaine."

"But he is employed by Hannas."

"John Comaine is the slave of Gaspar Hannas," rasped Brelekko. "I know the story—I alone, besides the two of them. A young man, a brilliant scientist but mad with the thirst for wealth, Comaine came to the battered hulk that was the first New Moon. He lost too much—money that was not his to lose. Hannas let him pay the debt with his science—and then held the new crime over him. Comaine tried at first to escape, but every effort left him deeper in the power of Hannas. He still has the pride and the heart of a scientist. He first dreamed of the New Moon, commander, not as a gambling resort, but as a superobservatory and laboratory of all the sciences, to be stationed out beyond Pluto. It was the ruthless power of Hannas that turned his dream into this. Would it be too strange, commander, if a scientist, revolting against twenty years of such slavery, should make his science strike back?"

"Perhaps not," said Jay Kalam. "Thank you, Brelekko."

He detailed two plain-clothes men to shadow the gambler, and sent for John Comaine. When the engineer appeared, stiffly awkward, the square stern mask of his slightly pop-eyed face hiding any emotion, the commander asked him the

same question about the Basilisk.

Comaine shook his big blond head, impassive as a statue.

"The Basilisk is a scientist," said his flat, harsh voice. "I know, commander, because I have been setting my own knowledge against his. And I have failed. I have met only one mind equal in ability to the feats of the Basilisk—the mind of Dr. Max Eleroid."

"But Eleroid is dead!"

"My only suggestion, commander," the engineer said flatly, "is that the cadaver in question was not properly identified."

Two more operatives were sent to follow him.

AN ORDERLY, in the legion green, was admitted.

"Commander Kalam." He saluted. "We have reports from the principal stock exchanges on all the planets. As you surmised, sir, the shares and obligations of the New Moon Syndicate fell precipitately upon news of what happened here—to about three per cent, in fact, of their former value.

"The reports confirm your belief, commander, that a financial battle has been in progress for control of the Syndicate. One side has evidently capitulated. The other is now able to buy at its own price."

Jay Kalam nodded gravely.

"Has the buyer been traced?"

"It has always been very difficult to discover anything about the affairs of the New Moon Syndicate, sir. They are handled by very devious means. The legion exerted pressure, however, upon several brokers. The reports indicate, almost surely, that the buyer is Gaspar Hannas!"

"Eh?" Old Giles Habibula started. "But Hannas is the New Moon's master, already."

"He is head of Syndicate," Jay Kalam told him. "Originally, he was sole owner of the enterprise. But the cost of constructing the New Moon, while the actual sum has never been revealed, must have been staggering—far beyond the resources of Hannas. He was forced to sell a vast amount of stock, and the Syndicate incurred tremendous obligations.

"Out of that fact comes the chief reason for suspecting that Hannas himself is the Basilisk."

"Eh, Jay?" Giles Habibula turned pale and began to perspire. "And here we're in the New Moon. in the very clutch of his mortal power! But why do you think it, Jay?"

"Even through the cloud of mystery that is always kept around the affairs of the Syndicate, it's clear that Gaspar Hannas was about to lose the New Moon. The activities of the Basilisk have enabled him to buy back control at his own price.

"There—in the difference between bankruptcy and possession of the System's greatest fortune—you have motive enough, I think."

"Aye," agreed Giles Habibula. "But you said this Basilisk must be a scientist—and Gaspar Hannas is no scientist."

"But he has a very able one—if Breleggo told the truth—completely under his thumb. John Comaine." Jay Kalam rubbed thoughtfully at his jaw, and then his dark eyes went abruptly to Giles Habibula. "However," he said, "all the weight of evidence still rests against Chan Derron.

"For Chan Derron took Dr. Eleroid's invention—which is probably the very scientific agency that has baffled us. He has been connected—though sometimes a little too obviously—with every crime of the Basilisk. He was here, loaded down with concealed instruments, when little Davian was taken. And again he has mysteriously escaped.

"I have been reluctant to believe that so fine a legionnaire as Captain Derron was, could have turned to such a monster as the Basilisk. But the android

accounts for that. Probably Luroa was the mysterious spy who frightened Dr. Eleroid! And then she met Chan Derron."

Somberly, his dark eyes looked far away.

"He would not be the first man degraded and destroyed by the fatal allure of the evil creatures of Eldo Arrynu!"

"So, Jay," sighed Giles Habibula. "But yet they were mortal beautiful!"

Jay Kalam's glance came back to the old man, suddenly intent.

"Giles," he said softly, "I've an idea!"

"Eh, Jay!" The fishy eyes blinked uneasily. "You're getting too mortal many ideas about a poor crippled old hero of the legion, Jay. But what is it?"

"You are ordered, Giles, to find Chan Derron."

"But we're all looking for Derron."

"You haven't been exerting your full capabilities, Giles. As commander of the legion, I order you to find Derron and the woman with him. By any means you can. You will work alone. But keep in touch with the legion—take our experimental portable visi-wave relay—and call for any aid you need. Get into their confidence. You have boasted enough of your cloudy past—you might well pretend to be another criminal! Learn everything you can. Learn where the headquarters of the Basilisk are, and the machine—whatever it is—so we'll be able to use AKKA. And trap Derron and the android."

Giles Habibula licked his pale fat lips. He gulped. His round seamed face looked greenish-yellow, and it glittered with sweat. He gasped for breath, and mopped with a trembling hand at his bald brow.

"Jay!" he wheezed at last. "Jay, my mortal soul! Are you out of your blessed mind? In all these years, hasn't old Giles given enough to the System—aye, his blessed all!—without being flung into this nest of fearful horror?"

His fat hand quivered on Jay Kalam's arm.

"In life's name, Jay, stay your cruel command! Ah, think, Jay! Why poor old Giles might be snatched from beside you at this blessed moment—to be found in the black Euthanasia vault, with the blade of the Basilisk in his poor dead back!"

"That is my command, Giles," Jay Kalam said gravely. "Remember, it is for the sake of Aladoree."

Giles Habibula caught a sobbing breath.

"For Aladoree!" he wheezed. "For her, Jay . . . I'll go."

THEN the commander of the legion went suddenly tense, and his lean face went a little white.

Krrr! Krrr! Krrr!

The tiny sound, peculiarly penetrating and insistent, was humming from the communicator hung by its thin chain about his neck. The commander's lean deliberate hands, drawing the little black disk from under his clothing, trembled a little.

"It's *G-39*," he told Giles Habibula. "Emergency!"

Giles Habibula watched apprehensively as he touched the dial, whispered a code response, and lifted the little disk to his ear. The straining ears of the old legionnaire failed to hear anything. And the face of Jay Kalam didn't lose its grave, contained reserve. But his failure to breathe, and his frozen stiffness, betrayed enough.

"You've had bad news, Jay," whispered Giles Habibula, when at last the commander lowered the disk and broke communication. "Aye, mortal bad!"

Jay Kalam nodded, very slowly. His lean face, beneath that one white lock on his forehead, looked the oldest that Giles Habibula had ever seen it.

"That was one of the subordinate officers, calling through the visi-wave relay at Base from the depot of the

cometary expedition, on Triton." His voice was very quiet. "The depot has been robbed, Giles. All our files and specimens rifled."

"Eh, Jay!" Giles Habibula blinked at him. "The secrets of the cometeers!"

"All our most valuable—or most dangerous—notes were taken, Giles. Weapons and instrumentalities that we had planned to guard at least a thousand years, before civilization could possibly be ready to assimilate them. All gone!"

"Was it . . . the Basilisk?"

The stricken head nodded again.

"A little black clay snake was found on Bob Star's desk, inside the vaults; none of the locks on the vaults, by the way, were disturbed. And they found another clue. Dropped on the floor was a yellow reservation check, from the New Moon. It was dated yesterday. And the name on it was Dr. Charles Derrel."

"Derrel?" gasped Giles Habibula. "But, Jay, it isn't six hours since I picked that check out of Chan Derron's pocket—and Triton, by the swiftest cruiser, is four mortal days away!"

"The best proof yet." Jay Kalam said gravely, "that the Basilisk is Chan Derron." His lean hand gestured. "Now you've *got* to get him, Giles."

"But . . . Bob?" Giles Habibula was wheezing anxiously. "You say a subordinate was speaking? Where was Bob, Jay?"

The face of Jay Kalam was stiffly bleak.

"The officer said that Captain Robert Star is mysteriously missing from the depot," his faint voice said. "Giles, Bob Star is doubtless now in the hand of the Basilisk! Alive—we don't know—or already dead."

Giles Habibula lifted himself laboriously to his feet, with the cane.

"Bob, the poor lad!" he sobbed bitterly. "'Tis mortal plain that I must go, Jay. For Bob, and for Aladoree. But how shall I find Chan Derron, Jay?"

The seamed yellow globe of his head shook hopelessly. "How can one poor old man track down the fearful monster that strikes at midnight here, and on the far-off moon of Neptune before the blessed dawn?"

His pale eyes rolled.

"Or, in life's precious name, what if I do find him? And the mortal woman? One crippled old soldier, to face the System's two most frightful criminals. Aye, to face all the evil power of the Basilisk! And that woman, whose very beauty is a false mirage and a consuming flame and a poisoned blade!"

He blinked, and caught a gasping breath.

"But, for all that, I must go! Farewell, Jay. Farewell. And please tell Aladoree that poor old Giles Habibula was loyal to the end." He thrust out a trembling hand, and the commander grasped it. "For it is mortal likely, Jay, that Giles Habibula will never be seen again!"

And he waddled slowly out into the corridors of the New Moon.

XI.

BACK in the rich, soft-toned simplicity of the hidden, ray-armored apartments aft the chart rooms of the mighty *Inflexible,* once more in the trim gold-and-green of his uniform. Jay Kalam was waiting. The deep muffled song of the geodynes reached him briefly, as a door was opened. And Hal Samdu came stalking in, with a worried look on his rugged, ugly face.

"Well, Hal?" The quiet reserve of the commander's voice did not conceal his eagerness. "What is your report on the robot?"

The big gnarled hands of the admiral general laid a thick green envelope on the table before Jay Kalam. They clenched, as he raised them, with a savage force.

"If I could reach this Derron—" His great voice was thick with a baffled agony. "To think, Jay, that all the

legion can give Aladoree no promise of safety!"

"I know it is appalling," said the grave commander. "But your report?"

"In the envelope," rumbled Hal Samdu. "I got together twenty men, half of them veterans of the comet expedition, all of them specialists in some field of science. They took the robot thing apart, and studied every piece of it, by every possible means. The lab work was finished, twelve hours ago, at base. Since, they've been discussing and checking the meaning of their discoveries, and writing up the report."

Jay Kalam was leaning forward, anxiously.

"What did they find?"

Hal Samdu shook his rugged white head.

"I'm no scientist, Jay. It's all in the envelope."

"But," the commander asked, "in brief—"

"As you surmised, Jay, it's an illegal robot. It makes use of biophysical principles forbidden in the same Green Hall statutes that outlawed the androids. The most similar illicit model in the museum was one taken shortly after the war with the Medusae. It was built by a young Dr. Enos Clagg, who was sentenced to three years on Ebron."

"The details?"

Hal Samdu touched one big knobby finger with another.

"First, Jay," he rumbled, "they concluded that the thing was designed by a human engineer—a man trained in the System."

Jay Kalam nodded. "Why?"

"Because so many familiar engineering principles were used in its construction. There were none of those strange freaks of design—strange to us—that we found in the machines of the Medusae and the cometeers.

"The thing was driven by an atomic power tube. There were pinions, shafts, cams, cables, levers—all used just as a supremely good human engineer would use them, if you set him to build a mechanical imitation of . . . of whatever monster the thing was copied from."

Jay Kalam was rubbing reflectively at his jaw.

"That fits Derron well enough," he said. "He took high honors, I remember, in the engineering section of the academy. But, for that matter, it fits the android, or Hannas, or Brelekko or Comaine. What else, Hal?"

The gigantic captain general bent down another gnarled finger.

"Second," he said, "they agreed that the thing was built outside the System."

Jay Kalam nodded again, without surprise. "Where?"

"On a planet somewhat larger than the Earth, they concluded, comparatively near a dying red sun—a star of the type designated as K9e. The surface gravitation of the planet is about 1250*g*—about one and a quarter times Earth gravity. The atmosphere is denser than Earth's. It contains sufficient free oxygen to sustain human life—but also enough free chlorine to make it very unpleasant."

THE commander was listening intently.

"And the basis of those conclusions—"

"The metals of the robot, in the first place. They are mostly aluminum and beryllium bronzes. They are alloyed according to standard metallurgical formulæ. But spectrographic analysis proves that they were not smelted from any ores mined in the System. The impurities are minute in quantity, but the metallurgists declared that the evidence is conclusive.

"The deposits of corrosion, in the second place, on the body of the thing. They contained chlorides, due to the action of free chlorine. And you recall the stink of chlorine in the air, when the thing appeared?"

Jay Kalam nodded, intently.

"In the third place, Jay," Hal Samdu

rumbled on, "there are the life forms they found in the green slime clinging to the thing. Micro-organisms of types unknown in the System. I'm no bacteriologist, and you'll find details in the report.

"But some of them are queer things, I gather. They perish, in the normal conditions of the system, for want of chlorine. And thrive on the chlorine in some of the common bactericides. Some varieties break down chlorides, and liberate free chlorine. If they ever got established in the oceans of Earth—" Hal Samdu's cragged face set grimly. "I hope Derron doesn't think of that!"

The commander was asking, "What else?"

"They attacked the problem from another angle," said Hal Samdu. "The robot thing was obviously a mechanical reproduction of a living original. It has many features, such as the scales, beak, teeth, gill and nostril vents, which, being useless to a machine, prove that conclusively. And the fact tells a great deal about the alien environment in which the original lived."

Jay Kalam held up a lean hand.

"One question, Hal. Why should the robot have been copied after such an original?"

"The scientists discussed that, Jay. Besides any possible intention to deceive other creature of that world, or to mislead and terrify the people of this—"

The rugged brow of the admiral general furrowed with a frown of concentrated effort.

Besides, Jay, there is the general speculation that machines designed to operate efficiently, under any given set of conditions, must frequently follow the same principles that life has found most efficient under those conditions—the very words of the report! Why don't you just read it, Jay?"

But the intent commander motioned silently for him to go on.

"From the dimensions of the thing, and the amount of power provided for the functioning of its limbs and wings," Hal Samdu resumed laboriously, "particularly from the size, strength, weight and camber of the wings themselves, in relation to the total weight—from all that, the scientists arrived at precise data on the atmospheric density and surface gravity.

"From a study of the cooling system, heat insulation, and lubricants used—checked against the optimum temperature conditions for the strange micro-organisms—they closely estimated the temperature of the planet.

"The photo cells that served as eyes for the thing revealed a good deal. From their sensitivity, the range of their iris diaphragms, and the nature of the color filters used, it was possible to determine very exactly the intensity and the color of light to which they were adapted—the light of a K9e sun, within a certain range of distances.

"One deduction checked against another, to verify and refine the first approximations. I've been able to give you but a clumsy sketch of it, Jay. Aye, the science of the system has become a fine and powerful instrument!"

"Too powerful," Jay Kalam said, "in the hands of the Basilisk! But what else, Hal? Anything on how the robot arrived in the New Moon—and how Davian was taken away?"

HAL SAMDU shook his shaggy white head.

"There was no physical evidence, Jay. One of the geodesic physicists suggested a theory. Something dealing with the achronic force fields we use in the visi-wave—a possibility of geodesic warp, such as Kay Nymidee used to escape from the comet.

"You'll find his speculations in the envelope. But they are too vague for any practical use. With our data from the comet expedition, he might have

worked out something—but that is gone."

"Then," Jay Kalam demanded, "have you anything on the location of this star?"

"It's in the envelope, Jay," Hal Samdu continued desperately. "The astrophysicists did another remarkable piece of work. They listed all the K9e stars in telescopic range—they are not very luminous, you know, with a surface temperature just above three thousand, and the number known is relatively small.

"They checked off nearly half which are binaries, and hence could have no planets. Most of the rest were eliminated because spectrographic studies revealed no trace whatever of absorption by free atmospheric chlorine.

"Of the score that remained, another half were eliminated because their spectra indicated that they had recently been through nova-eruptions, and hence would not possess living planets. And all the rest proved either too small to maintain a planet as the calculated temperature, or so massive that a stable planet could not have existed at the calculated distance—all the rest but one, Jay!"

Hal Samdu grinned.

"Aye, Jay, there's one star—and only one—that checks with all our results."

The commander stood up abruptly, behind his desk.

"What star is that?"

"They showed it to me, in the telescope, Jay. It's a very faint red star in the constellation Draco. Known as Ulnar XIV., after one of the emperors. Its distance is eighty light years."

Jay Kalam's thin lips pursed.

"Eighty light years! Then it would take us two years to reach it, at the full power of the *Inflexible*—and we should arrive without any fuel left for action or return."

His lean head shook slowly. Thin, unconscious fingers combed the one white lock back from his forehead. His

dark eyes stared at Hal Samdu, with a fateful intensity.

"Hal—" he whispered suddenly, hoarsely. "Hal—I see but one thing to do! It is a terrible thing—it is hard to picture anything more terrible than life, the helpless child of a star, daring to destroy a star. And that is no certainty that it will end the Basilisk—we have spun our assumptions out too far."

He caught his breath, as if with an effort.

"However, I am going to order the destruction of the star Ulnar XIV." His dark eyes slowly closed, and opened again. "Another time, Hal, I waited too long. Great as a star is, the life of the System is greater."

"Aye," rumbled Hal Samdu. "Strike!"

THE commander of the legion found the little black disk of his communicator. His thin, trembling fingers turned the tiny dial, tapped a series of keys. His thin lips whispered into it. Hal Samdu sat watching him, his cragged red face rigid as a statue's.

At last Jay Kalam lowered the instrument.

"It is unfortunate that no visi-wave equipment has yet been installed on Phobos," he said. "I am communicating direct, on the ultra-wave. But Aladoree is more than a hundred million miles away. It will take nine minutes for the message to reach her.

"In ten, the star Ulnar XIV should have ceased to exist in the material universe—although terrestrial astronomers will naturally not be able to confirm the fact for eighty years!"

He paced a nervous turn across the end of the big silent room, beyond the desk.

"Twenty minutes," he muttered. "Before we can hear from Aladoree—"

"What was that?"

Hal Samdu was suddenly peering about the empty room, barytron blaster level in his big gnarled hand.

"Didn't you hear it, Jay?" he demanded. "A deadly muffled pur! Or feel a breath of bitter cold?"

"I heard nothing, Hal." Jay Kalam sighed, wearily. "We've been under too much strain. I'll order you something to drink. And look through the report, while we're waiting."

He broke the seal on the big green envelope.

"Eh!" His jaw fell slack. "This is no report!"

"But it is, Jay! It hasn't been out of my sight."

Out upon the desk the commander poured a score of neatly tied packets of little yellow slips.

"These are I O U's!" he gasped. "Payable to the New Moon Syndicate—they must have come from the vaults of Gaspar Hannas! And here . . . here—"

His trembling fingers had found a familiar sheet of stiff crimson parchment. It bore the serpentine monogram, and upon it, in that precise familiar script, was written:

> MY DEAR COMMANER:
> Admiral-general Samdu's brilliant summary has given you a sufficient idea of the genuinely brilliant work of his investigators, and I believe that circumstances will very shortly prove the document to be no longer of value to you.
> THE BASILISK.

"Derron!" Waving the barytron gun, Hal Samdu was peering wildly about the great armored room. "We can't escape him—not even here! If Giles doesn't get him—"

Jay Kalam was still staring at the red sheet, with dull, lifeless eyes, when: *Krrr! Krrr! Krrr!* shrilled the tiny, piercing emergency call from his communicator. With stiff fingers he groped again for the little black disk, set the keys, held it to his ear. Hal Samdu, watching, saw his face grow deadly white.

The instrument at last dropped out of his fingers, and he swayed over the desk, holding himself up with trembling arms.

"It wasn't the reply," Hal Samdu was rasping hoarsely. "There hasn't been time! What has happened, Jay?"

The lusterless, glazing eyes of Jay Kalam stared at him.

"The worst, Hal," he whispered. "That was someone calling from Phobos—the call crossed ours. And the Basilisk has struck again. And he has taken them all. John Star. And Bob's wife and her child. And—"

He made a bitter little shrug of hopeless defeat.

"And—Aladoree!"

XII.

THAT MIGHTY, feral pur receded. The icy cold was gone. Chan Derron could breathe again. He swayed unsteadily, still on his feet, and tried to see where he was. But a smothering darkness wrapped him.

His heart was hammering. His breath was a rapid gasping. Cold goose pimples still roughened his body. He had been snatched from before the menacing weapon of Vanya Eloyan, he knew, by that uncanny agency of the Basilisk—and his very vanishing, he also knew, the girl would take for absolute proof that he was himself the criminal!

But now—*where was he?*

In some confined black space. His feet scraped on a metal floor, and the swift ring of the sound told him that walls were near. He stumbled forward, and his hands came upon a barrier of cold metal.

Was this the vault of the Euthanasia Clinic—and the thought drove a cold blade of panic into him—where another victim of the Basilisk had been found murdered? Was death waiting for him, in this thick darkness, now? What was *that?*

He crouched and spun. Intently he listened, but there was no sound beyond the prompt echo. His eyes strained vainly into the blackness. His hand swept instinctively toward the holster

under his cloak. And then he remembered, with a sinking sickness in his heart, that the girl had disarmed him.

Something brushed his shoulder. He put up a defensive arm, and something tapped it again. He tried to quiet a pounding heart, and groped before him. It was only a swinging pendant. He pulled at it, a blue-white glare of atomic light blinded him.

For a moment he had to cover his eyes. And then, staring about, he blinked again in wonder. This was indeed a vault—just before him was the ponderous lock-mechanism of an armored door that must have weighed two hundred tons—but in no crematorium.

For the long shelves that lined the branching narrow corridors were stacked with the heavy bags and rolls and packets that were the symbols of inordinate wealth. They bore neat little signs, to identify chips and scrip and coins and bills of various denominations. And every bag and roll and packet bore the yellow crescent that was the New Moon's emblem.

This, amazed realization broke upon Chan, was the New Moon's treasure vault!

Then he noticed a curious thing. The scrip of the New Moon Syndicate, the chips used at play, and the bags of coin, were all apparently intact—but upon the shelves labeled Green Hall certificates, there were only stacks of little clay bricks.

The vault had been looted! What remained was almost worthless—all the real money was gone, with only mocking clay left in its place!

And his tall body went suddenly rigid and cold. For the vault would presently be opened—probably it had been locked, for safety, during the Basilisk's promised attack, during the man hunt that must yet be going on without. When it was opened, the loss would be discovered. And the hunters would find their prey—cornered.

IN THE SILENCE of the vault, Chan began to wonder if the power that had put him there still watched him. His strained nerves could feel alert and hostile eyes upon him. Imagination pictured the Basilisk laughing at him—a low, thick chuckle, he thought of it, cold, diabolical, inhumanly gloating.

"Well, Mr. Basilisk?" He couldn't stop his own wild, ragged voice from talking into the mocking silence. "What am I to do now? Sit down and cry? Tear my nails out scratching at the wall? Hang myself from the shelves? Or just let them find me?"

It was hard to keep from screaming. He paced up and down the metal floor, driven with a savage, futile energy. Fancy pictured a sinister presence, lering from beyond the shelves.

"Well, can you hear me?" he choked. "How does it feel to be a god, Basilisk? To watch every man in the System. To follow all who try to escape your power, wherever they go. To take what you will. And slay whom you will!"

He shook his fist against the bare metal wall.

"It may feel pretty great—to your twisted brain, Basilisk! But you won't last forever! For some poor devil will get you—somebody that you've mocked and tortured and battered until all that keeps him alive is a little voice that says *kill him, kill him, kill him!*

"Somebody, Basilisk, like me."

Then it happened that his aimless pacing brought him to the scrap of paper on the floor, happened that his wildly staring eyes glimpsed the scrawled symbols on it. With a little eager, wondering exclamation, he snatched it up, smoothed it with his fingers. He studied it anxiously.

A small oblong sheet, torn across one end. Scratched upon it, in hasty pencil marks, were three heliocentric space-time positions, followed by a series of figures in which Chan could see neither relation nor meaning.

The first position designated was that occupied by the New Moon, Chan recognized—and precisely, it was odd, at the moment of that midnight on which the Basilisk had taken the little gambler, Davian.

The second position—and the thing that had first caught Chan's eye—was a point located in the constellation Draco, at a distance of some ten billions of miles from the Sun. The familiar co-ordinates were those of that unknown object that Chan had discovered when he fled northward from the legion fleet; the object to which he had been planning to escape when the mocking power of the Basilisk drove him to turn back and fight.

The third position was also in the Dragon—but at a heliocentric elevation which Chan quickly interpreted into the amazing distance of eighty light years.

After a few moments of study, Chan Derron slipped the crumpled scrap very hastily into the pocket of his tunic, and fervently hoped that the Basilisk wasn't looking—after all, he told himself, a presumably human brain must be limited in its power of attention.

The millions of tons of that object in space had been an utter mystery. This bit of paper seemed good evidence that it was connected with the Basilisk. And the discovery opened the faintest possible chance—

"If I can get out," he muttered, "out of here and out of the New Moon and back to the *Phantom Atom*—if she's still safe where I left her—if I can get aboard her, and escape the legion fleet, and get out to that object—"

His voice fell to a soundless whisper.

"If I can do all that, Mr. Basilisk—look out!"

Giant shoulders square again, he strode to the lock. Its bolts and levers were uncovered for him to see—bright metal bars weighing many tons. But they were fast. His desperate strength and frantic eyes could discover no way to move them.

"If Giles Habibula were here—"

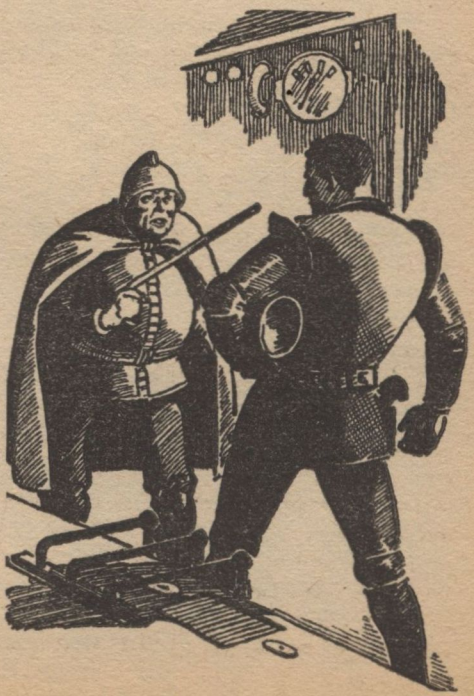
Wistfully, he recalled the fabulous exploits of the old legionnaire in picking the locks of the Medusae and opening the guarded vaults of the cometeers. Habibula, doubtless, with all this mechanism open before him, could have opened the door at once.

But Chan Derron was completely baffled.

HE WAS standing back, panting, sweat-drenched from useless effort—when something clicked, concealed motors hummed, and the great bolts began to slide slowly back, of their own accord.

It would be the men of Gaspar Hannas, of course, opening the vault. Chan Derron's hand flashed automatically to his armpit, again, and found only the empty holster of his barytron blaster, and the straps that held the compact unit of the geopeller to his body.

Weaponless, he could only wait, watching the appallingly deliberate well-



oiled movement of the bolts. In the geopeller, ironically, lay power to carry him across a hundred million miles of space—but not through these armored walls. At last the bolts were withdrawn, and the ponderous disk of the door swung slowly open.

"Hasten, you fools!" a great harsh voice was booming. "I must see if all is safe." That must be Gaspar Hannas himself, driven wild with a well-founded fear for his treasure. "If the Basilisk can do what he has done, he can enter this vault."

"And there he is!" It was a triumphant shout. from a half-glimpsed man in the yellow of the New Moon's police.

The violet, blinding tongue of a proton blast whipped through the widening opening. And the voice of Gaspar Hannas bellowed:

"Forward, men! We've got him! He's worth half a million—remember—dead or alive! And the woman—if she's with him—half a million more!"

Chan Derron had stepped swiftly aside, at the first flash of the ray. He waited, listening. There must be a score of men without, he knew from the little sounds of feet and breath and weapons, alertly advancing.

He snatched the swinging cord, snapped off the lights in the vault.

"Come out, Basilisk!" boomed the tremendous voice of Gaspar Hannas. "With empty hands! Or we'll come in and get you!"

Crouching in the darkness, he made a last appeal:

"I'm not the Basilisk, Hannas." His voice stuck and quivered. "I'm Chan Derron. More a victim than anyone. If you'll believe me, Hannas—"

"Forward, men!" thundered Hannas. "He admits he's Derron, and we've caught him in the vault! Burn him up!"

The door was swinging wider. Out of the darknes, Chan watched the men creeping forward. Their white eyes were peering desperately, looking swiftly and uneasily aside. They were shifting their proton guns in sticky hands.

Chan gulped, tried to still the shuddering dread in him.

"You are afraid of me," he called. "Every one of you. I can see the pallor and the sweat of fear on all your faces. I can see fear crawling in your eyes. Well, you had better be afraid! But it is the Basilisk you ought to fear, and not the man that the tricks of the Basilisk have loaded down with suspicion. I, too, am hunting the Basilisk. And now I have some information. I can help you—"

The great voice of Hannas cut him off: "You've got too much information, Derron! But it will die with you. *Get him, men!*"

And the men in yellow slipped forward again.

Chan Derron caught his breath, and snatched one of the mocking clay bricks off the racks. And his tense fingers gripped the little black control spindle of the geopeller, at the end of the cable that ran down his sleeve.

"If you can!" he shouted. "But you won't get your treasure, Mr. Hannas! Your vault is stripped clean. Here's what is left!"

And he flung the little brick, so that it shattered against the face of the door. Fragments pelted the men beyond. Half a dozen blinding jets leaped, as nervous fingers contracted. One man, sobbing an oath of fear, dropped his weapon and ran—until an officer's swift beam cut him down.

"Empty?" came the stricken voice of Hannas. "Empty—"

This was the moment. Chan filled his lungs with breath—for the speed of the geopeller made breathing almost impossible. He squeezed and twisted the control spindle. And the compact little unit on his shoulders lifted him. It flung him toward the wall of guns.

TO BE CONCLUDED.

BOOK REVIEWS

GENERAL MANPOWER, by John S. Martin; Simon & Schuster, 386 Fourth Avenue, New York City, 306 pages, $2.50.

Malthusianism and Capital's incoherent fear of that Big Bad Wolf, Communism, seems to have inspired this book. The scene is laid in 1959. The world is still restless; apparently nothing has been settled since 1939. Some of the outstanding men of our times are still alive—for instance, Mussolini, who is said to be still bragging about the conquest of Ethiopia—and Hitler, who, in the author's opinion, has become hopelessly insane. (This sounds like a wish fulfillment.) We also meet Anthony Eden, who is England's prime minister. England is ruled by Queen Elizabeth, who, as well as Queen Juliana of the Netherlands, is very much disturbed by the growth of Communism in the Far East. To purge their Far Eastern dominions of the Red menace, they call in one Orestes Jones, head of a vast enterprise known as General Manpower, conceived and created by Jones. As a child, Jones was puny and sickly, but by continuous and strenuous exercise, he develops himself into a professional strong man. He then started to sell mail-order courses of exercises with the slogan "Man or Mouse," which took the country by storm.

Soon he had millions of students.

Money started coming in, and then he enrolled the graduates of his "Man or Mouse" courses into a nonpartisan organization called General Manpower. He had thousands and more thousands of his graduates come to his headquarters at Ventura, California, for intensive training. Soon he has close to half a million men, all trained for all kinds of labor, including soldiering, and he rents them out to lumber camps, steel mills, mines, et cetera, on a profit-sharing basis. The idea clicks, and General Manpower prospers. There were, of course, numerous female students.

Jones decides to go to Mexico. This country is indebted to him for the rental of fifteen hundred shock troops for the quelling of sundry revolutions. Mexico owes Jones about three million dollars, and to offset this amount, Mexico cedes a large tract of land in Lower California to him, and the company moves there, lock, stock and barrel. This new settlement is called Valhalla and it soon flourishes. Valhalla acquires a navy, a large fleet of airships, and declares itself as the "State of Man."

At this time, the call for help comes from the two European queens, and Jones agrees to furnish two hundred and fifty thousand trained shock troops to "derouge" the Eastern empires of England and Holland. The I. E. F.—Indies Expeditionary Force—is cleverly infiltrated into the most infected areas, and under the leadership of General Perry O'Brian, a bloodthirsty swashbuckler, the red menace is lamed for many years to come. Blood-and-battle-mad O'Brian decides to carve out an empire for himself. He very bloodily takes over San Francisco, and claims all California for himself and his troops. America is stunned. There are countless conferences in Washington, which, as usual, produce nothing but talk. Then Jones steps in. He feels morally responsible for the California crime, and offers the resources of the State of Man to wipe out O'Brian and his army.

When O'Brian is killed, the fighting stops, and the remnants of both armies

march back to Valhalla. Jones is exiled to the Island of Nantucket, where he contemplates the invention of more efficient mousetraps, faintly regretting that his dream of using General Manpower's might to become peace custodian of the world was shattered through the greed for power of one of his generals.

"General Manpower" is worth while reading. It is quite plausible, fast-moving—and might come true if a man like Orestes Jones appears. I liked it immensely. C. A. BRANDT.

A HISTORY OF LAND MAMMALS IN THE WESTERN HEMISPHERE, by William B. Scott, Princeton University, New York: Macmillan, second edition, revised and rewritten 1937, 786 pages, $7.50.

The average intelligent science-fiction fan probably has a fairly clear idea of the Cretaceous Period with its climactic dinosaurs, and of the Pleistocene Period with its glaciers and mammoths, but at best a hazy idea of what happened between. Plenty happened. The interval in question took fifty or sixty million years, and many astonishing faunas rose and fell. For those who would like a clear picture of the story of life during this period, Professor Scott's book is not only just the thing, but the only thing. Written for the serious, intelligent layman, it has literally no competitors save the now-out-of-print "Age of Mammals" by Osborn.

Originally published in 1913, "A History of Land Mammals" has just come out in a new and much enlarged second edition. The great number of new discoveries since 1913 made it necessary to rewrite almost the whole book. There are many illustrations by Charles Knight and Bruce Horsfall, who are undoubtedly tops in the depiction of life of past eras. There are many new illustrations, and apparently only one of the illustrations of the first edition has been dropped without a substitute. (Mr. Hornsfall seems, parenthetically, to have gone a bit astray in the matter of proportions in his restorations of *Homalodotherium* and *Thomashuxleya*. But otherwise his pictures afford little or no scope for criticism.)

The author discusses the successive mammalian faunas of the Americas as wholes. Then he takes up each of the more important groups—Carnivora, Marsupialia, et cetera—in turn, tracing lines of descent from recent times back to the Age of Reptiles. The little shrew-like mammals of the Mesozoic have a chapter to themselves. The chapter on "The Skeleton and Teeth of Mammals" is a "must" for those who would like to know what paleontologists are talking about when they make remarks like, "The astralagus is convex on its distal surface"—from a label in the American Museum of Natural History.

While the book is a serious study and not a mere catalogue of freaks, we may mention some of the more bizarre members of Professor Scott's zoo: The horned gopher *Epigaulus*—I'll bite; what did he use the horns for?—the bear-sized beaver *Castoroides;* the prong-horned antelope *Synthetoceras,* with a long forked horn on his nose; the huge glyptodont *Dœdicurus,* whose tail ended in an enormous spiked club; the tree-climbing ruminant *Agrichœrus.*

The book is fairly easy to read. The author is determined that you shall know something when you've finished his book; but, on the other hand, he doesn't assume too much knowledge on the reader's part to begin with. For instance, he very sensibly begins with a chapter on "The Definition and Classification of Mammals," after which you have no excuse for haziness as to just what a mammal is. Nobody who is really interested in biological matters can afford to overlook this encyclopedic work.

L. S. DE C.

SCIENCE DISCUSSIONS and BRASS TACKS

"Have at ye, iconoclast!"

Dear Mr. Campbell:

It is many months since I last wrote to you about the policy or contents of Astounding, and this letter is not inspired by any feeling of disappointment in Astounding's progress. My annoyance has been aroused solely by a letter appearing in the February Science Discussions and signed by L. Sprague de Camp.

It may be well to say first that I am a great admirer of Mr. de Camp's work as a fantasy writer, in order to avoid any suspicion that I am working off a "peeve" against him. His general knowledge is really astounding and he writes in a flowing, pleasant manner. Unfortunately he insists on poking his agreeable nose into everything; like Wagner, Faust's assistant, a perfect busybody.

Quite a while ago he blithely destroyed the old Robin Hood legend in Discussions, but I let that pass. Now a chance paragraph in a short story affords him opportunity to once again air his knowledge with the result that he walks over King Arthur in the same urbane way. Against this I must protest.

In case you are now expecting some twelve-page historical thesis, I confess that even if I wished to, I could not reinstate Arthur after my Norman friend's ruthless vivisection. In all probability what he says is eminently correct—I have not studied the subject, and cede him superiority as far as academic knowledge is concerned. But I am a romanticist, and it is as such that I object to a perfectly innocuous and heroic fable being destroyed in the cause, I presume, of "science and progress." If de Camp is so very fond of "truth pure and bright," he could employ his talents to a better cause in the destruction of modern evils and leave the past to poets and "spineless dreamers" who can derive pleasure from it.

This pursuit of scientific truth has in it all the elements of a callous despair. Despite all its "tremendous strides" there seems little hope of an ultimate triumph. Even its dearest advocates in many cases realize its limitations—to cite but two familiar examples, both T. O'Connor Sloane and H. P. Lovecraft have affirmed their disbelief in the possibility of interplanetary travel and no race can rise to greatness within the bounds of a cramped and dying planet. And if the short distance between the earth and the planets is so doubtful of achievement, what of the interstellar vastnesses which even the fabulous—just how fabulous the *real* scientists could probably tell us—atomic power would still require lifetimes to traverse.

Mr. de Camp is obviously in love with science, and yet, faced with all the colossal tasks that await it, he can find time to waste in the destructions of legends which have given us such pillars of literature as Tennyson's "Idylls" and the works of Malory. Surely he will not stop now. May I point out that there is also "Beowulf" waiting for his lance, and he could point out the bad side of King Alfred, after which the city of Winchester—some eight miles from here—would have to pull down the antiquated statue they have so foolishly raised to him. If he ever visits Winchester, the ignorant peasantry—who, sad thought, will in all probability not have read his letters in Astounding—may show him the historic Table Rounde, which hangs in the Great Hall, and perchance to his scandalized ears may come the rumor that Winchester was once known as Camelot. And he may think, with the mellowness of experience, that perhaps his vendetta against British legends was not so very necessary after all.

Just one complaint re the magazine. The book jackets are both sensational and unnecessary.

Enough for now, but if Sire de Camp ventures into the letters section of Unknown I will personally attend to his permanent dishorsing—in a most Arthurian way—C. S. Goud, 244, Desborough Road, Eastleigh, Hants, England.

Question—

Dear Mr. Campbell:

In reference to Willy Ley's interesting letter in Science Discussions in the February Astounding, I should like to ask a question or two.

First: Why should the "orbits" of spaceships, shielded from all gravity, not be straight lines? It is true that ships leaving the Earth would have motion derived from the rotation and revolution of the Earth, but this motion would be in a straight line if no force were acting on the ship in space to deflect it. Once the ship was shielded from gravity it would leave the Earth through centrifugal force just as a stone leaves a whirling slingshot when it is released. It is one of the primary laws of motion that an object

in motion moves in a straight line except as some force deflects it from its course. The stone from the slingshot falls to the ground in a curving path because gravity pulls it down. But the ship is supposed to be shielded from gravity, so what is going to make it follow a curved orbit? It appears that such a ship should follow a straight line with reference to the Sun.

The Sun and the whole Solar System is in motion, and if this motion departed from a straight line appreciably during the flight of the ship, then the ship would travel in a curve with reference to the Sun. But I have the impression that the motion of Sun is not well enough known at the present time that it could be used to show how a gravity-free ship could depart from a straight line unless turned by rocket power or other means of propulsion. Probably the curvature of the path of the Sun would be too small to be of any importance in this problem, anyhow.

Why could not a gravity-free ship be set on a course and expected to travel in a straight line as long as desired?

My second question is this: Why should it require impossibly tremendous strength for a man to step onto a gravity shield which would render him weightless? The shield is supposed to cut off gravity just as light is cut off by an opaque substance. Above it and around it there would be no repelling force preventing the man from stepping on it. The sole difference between the area above the shield and surrounding space would be the weightlessness of objects in the "gravity shadow" over the shield. If a man thrust his arm into the "shadow," the only difference he would notice would be the fact that it required no muscular effort to hold up his arm, since it would be weightless.

It seems to me that if he attempted to walk onto the shield he would have no difficulty—in fact, once he entered the shadow he would not be able to stop, because his feet would not press against the floor. Due to his momentum, he would float right across the shield, and if it were very wide he would possibly turn in the air and land on his head on the far side of it. If he attempted to stop by pressing his feet against the floor he would merely bounce himself against the ceiling—if he were fortunate enough to have one over him.

It seems reasonable to me that gravity shields may be as impossible—as Mr. Ley says—as perpetual motion. But once granting the existence of such shields, I believe the things stated above are the logical consequences. If I have overlooked something and I'm wrong, I'd be glad to know of it. Would you be so kind as to refer this to Mr. Ley and give him the opportunity to answer either directly or in Science Discussions? I believe further explanation would interest other readers.

I liked "Crucible of Power" best and "Nothing Happens on the Moon" next best.

Would like to congratulate you on the excellent start made with Unknown. This is the best issue of a fantasy magazine I have seen. It was consistently good all the way through. "Sinister Barrier" was a gripping story. I was interested in the background of fact behind it. If you have a letter department in the magazine I hope there will be more information along this line—particularly as to the actual nature of fireballs, and something about the Charles Fort mentioned.

"Dark Vision," "Where Angels Fear—," "Trouble With Water," and "Who Wants Power," were all away above the average of science-fiction or fantasy stories and all distinctly different. Here's hoping you can keep this high level of novelty and good work—D. R. Cummins, 221 Jay Street, Sacramento, Cal.

And Answer.

Dear Mr. Campbell:

Many thanks for the opportunity to reply to Mr. D. R. Cummins' letter, which apparently expresses some thoughts and doubts entertained by quite a number of readers.

As to the first part of Mr. Cummins' letter, I have to say that he is apparently visualizing completely gravity-shielded spaceships that are

also equipped with rocket motors as a means of locomotion. I grant that such a vessel *might* travel along a path that is to all intents and purposes a straight line—but that is not quite what I had in mind. When I wrote my letter on gravity plates I was thinking of the old-time conception of space flight, picturing a ship equipped with gravity plates only. A journey of such a ship was thought to be accomplished in the following manner: At the beginning of the flight all gravity plates are turned on so that the ship, being weightless, floats up in the atmosphere until free space is reached. This static lift would at first accomplish much more than the fact that the ship is "left behind" by the planet. In fact it is not really left behind, having the same velocity and direction of flight as the planet itself, it only would not follow the curve of the Earth's orbit around the Sun. At any event, the ship would recede very slowy at first; after attaining some distance, those gravity plates that ward off Earth's gravitational influence would be left in operation, while the others that point in the approximate direction of the goal would be turned off. The ship would then follow gravitational fields with voluntary selection—somewhat similar to the *Arachne*, which is, of course, an equally fantastic conception. Main point is, however, that those orbits would also be curved.

Having cleared up this point I turn to the other objection. Well, I admit that it is hard to visualize the peculiar features of a gravity shadow if it were possible to produce such a thing. One simply cannot understand why it should be impossible to step upon a sheet of cavorite, or whatever you wish to term it. But everything I said about it is, nevertheless, true. A difference in gravity potential is an invisible barrier that quickly becomes an impenetrable barrier if the difference is worth mentioning. It might be easier to picture the thing the other way round. If, say, a billiard ball could roll off the shield it would suddenly acquire a kinetic energy equal to that of the same billiard ball falling from an infinite height. You could not get all that energy for nothing. You would have to put it in first when you place the ball on top of the shield. And that would be equal to shooting it into infinity, as anybody knows who really understands the significance of that letter *g*. It follows that such a shield would also be the absolute protection from all kinds of enemies and guns. If you could step upon it, the barrier of difference in gravity potential would afford absolute protection, no projectile would carry enough energy to break through and the only means to reach you at all would be a full-fledged spaceship, fueled for a trip to Mars and back. As I said before, it might be hard to visualize all this, but the facts are correct, and I maintain everything I said about it—Willy Ley, 3533 29th Street, Long Island City, N. Y.

2+2=3!

Dear Mr. Campbell:

I have finally found the formula I promised Mr. Frank De Sua. Correct me if I'm wrong.

$$M = \frac{w + v}{1 + \frac{wv}{C^2}}$$

, where M is the velocity of a point with reference to system one, and w is the velocity of the point with reference to system two, and v is the velocity of system one with reference to system two, and C is the speed of light.

Now, if v equals zero—that is, if system one is not moving in relation to system two, M then equals w, which is certainly logical.

If w equals zero—that is, if the point is not moving with refernce to system two, then M equals v, which is also logical.

Now let us consider Mr. De Sua's problem: "Two bodies each traveling 185,000 m. p. s. in opposite directions are still going less than 186,000 m. p. s. in respect to each other."

Shall we re-phrase it? Let the point in the formula be one of De Sua's bodies, system one of the formula, the other. Then, w, the velocity of the point with reference to system two, is

equal to 185,000 m. p. s., and v, the velocity of system one—which is the other of De Sua's bodies—with reference to system two, is equal to 185,000 m. p. s.

Now we have two bodies traveling in opposite directions, each with a velocity of 185,000, *relative to the same system of reference.* This system of reference is system two of the formula.

What, then, is the velocity of one of those bodies relative to the other? In relation to the formula, what is the velocity of the point with reference to system one?

By substitution and computation I derive the value of 185,966 for M. That is, the velocity of one of these bodies as measured from the other, is just 44 m. p. s. less than the speed of light.

Immediately, Mr. De Sua, you protest. And I agree with you. Such an answer as I have given is absurd. For one thing, the speed of light is not exactly 186,000 m. p. s.; for another, *any* answer that implies as great an accuracy as does "44 m. p. s. less than the speed of light" violates the principle that you can have no more accuracy in the answer to a problem than you can have in the data given. Also, I had only a table of five-place logs. That is another effective reason for doubting the accuracy of the answer.

Using letters alone, and leaving numerals out of it entirely, is far better.

But you will be able to see that in this formula it is impossible to obtain a value for M greater than that of C, merely by substituting any value between zero and that of C for w or v.

If w equals C, and v equals C, then M also equals C. That is, if one of your bodies travels at the speed of light in one direction, relative to a certain observer, and the other body travels at the speed of light in the opposite direction, relative to the same observer, the two bodies, relative one to the other, are still not going faster than the speed of light.

So, you see, it is impossible to get a value greater than C for M, using real values between zero and C for w and v.

However, you might try $w = v = C\left(\frac{1+\sqrt{-3}}{2}\right)$,

and see what happens. Unless I am greatly in error, M will equal 2C. But, in actual practice, I would imagine, attaining velocities such as the above might be a bit difficult.

I do not touch upon your problem of a spaceship's going out from the Earth at a velocity nearly that of light and coming back to find that years had passed on Earth whereas it had seemed like minutes to the occupants of the spaceship. Perhaps 'twould be so; perhaps not.

But, should I get a brilliant thought, or what is more probable, find a formula somewhere to explain the idea, you can depend on me to shout forth lustily.

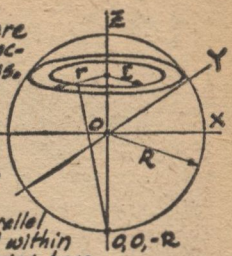
Here's to Einstein!—Allan Ingvald Benson, 5214 17th Avenue, N. E., Seattle, Wash.

Stephens asked for it!

Dear Mr. Campbell:

Mr. G. R. Stephens, in his letter in the Brass Tacks section of the February Astounding, has propounded a very neat mathematical problem. I spent some time sweating over it until I had a rush of the brains to the head and the answer fell into my lap.

The problem is stated as "what, in terms of the radius of the sphere, is the average distance from all points within the sphere to all points on its surface?" A moment's analysis will show that this is the same as the average distance from any one point on the surface of the sphere to all points within it. Then one commences. There are no less than six brute-force methods of extracting the answer, all of them involving triple integrals, cockeyed varying limits, and functions that can't be integrated by anyone less versatile than Einstein. But there is one neat and simple method that practically throws the answer at your face. It follows:



Assume your sphere centered at the intersection of your x, y, z axes. The coordinates of the point on the surface will be 0,0,-R, where R is the radius of the sphere. Assume a ring of infinitesimal width and thickness, around the z axis, parallel to the x,y plane, and within the sphere. Let the ring have a radius r. Then, the product of the distance from the point to the ring times the area of the ring will be

$$\sqrt{(R+z)^2+r^2} \times 2\pi r\,dr$$

This integrated from r = 0 to r = r gives the product of all the distances from the point to all the points on a slice taken thru the sphere coincident with the ring. r is the distance in the plane of the ring from the z axis to the surface of the sphere.

$$2\pi\int_0^r \sqrt{(R+z)^2+r^2}\; r\,dr$$

$$= \frac{2\pi}{3}\left[\left[(R+z)^2+r^2\right]^{\frac{3}{2}}\right]_0^r$$

$$= \frac{2\pi}{3}\left[\left\{(R+z)^2+r^2\right\}^{\frac{3}{2}} - (R+z)^3\right]$$

Now: $r^2 = R^2 - z^2$, and the integral of the area of the slice times the sum of the distance to the point, times dz gives the total sum of all the differential volumes of the sphere, each times its distance to the point.

or, Σ distance $\cdot \Delta V =$

$$\frac{2\pi}{3}\int_{-R}^{R}\left\{\left[(R+z)^2+(R^2-z^2)\right]^{\frac{3}{2}} - (R+z)^3\right\} dz$$

$$= \frac{2\pi}{3}\int_{-R}^{R}\left[\left(2R^2+2Rz\right)^{\frac{3}{2}} - (R+z)^3\right] dz$$

Integrating,

$$\left[\frac{2\pi}{3}\left[\frac{2}{5}R^{\frac{5}{2}}\cdot\frac{2}{3}(R+z)^{\frac{5}{2}} - \frac{z^2}{2} - \frac{1}{2}R^{\frac{1}{2}}z^2 - \frac{z^3}{3} - \frac{1}{4}z^4\right]\right]_{-R}^{R}$$

which, putting in the limits and simplifying,

$$= \frac{8}{15}\pi r^4$$

Divide this by the volume of the sphere, which is $4/3\pi R^3$, and you get

$$\frac{6}{5}R$$

which is the required average distance.

So there is my guess at the answer, which I

do *not* guarantee. If Mr. Stephens has a better answer, let him bring it forward. The same invitation applies to any other mathematician in the house. But I would ask Mr. Stephens, in the future, to confine himself to questions that don't make me work so hard—John D. Clark, Ph. D., 3809 Spruce Street, Philadelphia, Pa.

---

1. No large-scale experiments yet, so no one knows.

2. High-velocity particles plus radiant energy—which is heat.

3. Neutrons are released from heavy-hydrogen. Smash two heavy-hydrogens together, and free neutrons result. Finally, volts measures energy in this sense, because it is a measure of velocity-per-atomic particle.

Dear Mr. Campbell:

I have come across several interesting newspaper notices about new atom-smashing experiments, and I inclose one of these clippings. No doubt you have already heard a great deal about them, but I have several questions that I would appreciate having answered in the columns of Science Discussions, and I think these answers would prove of interest to a vast majority of readers.

The phrases I have underlined would indicate that a good deal of atomic energy is actually released, but I am not so sure, because volts is only a measure of electrical pressure, not quantity. And another thing, the article doesn't say whether a sufficient percentage of the uranium atoms are split to make the process anywhere close to practical. So I have the following questions:

1. What is the ratio of power released, in horsepower or kilowatts, to the power used by the process, in the same units?

2. In what form is the energy released; that is, is it released as heat energy, electrical energy, or high-velocity particles?

3. According to another article I have on the same subject, neutrons are used to bombard the atoms. Now, how are the neutrons generated, and how are they fired? I have always had trouble in figuring out how atom-smashing is done. I have heard a lot about magnetic fields being used, but how can a magnetic field effect the electrically neutral neutron?

I see that I have material here for a swell headache, so I leave you to your aspirin in peace—Robert Jackson, 239 W. State Street, Barberton, Ohio.

See the Editor's Page.

Dear Editor:

In the December issue of Astounding on page 151 there was an article on "Stored Power." Now, I only heard—but this is what I heard.

Not very long ago a genii or madman constructed an electric motor, operated from a 6-8 volt battery; the same as in your car. This battery turned the electric generators to a high speed which made the motor run and, what's more, recharged the battery. On a government test in our good old U. S. A., this arrangement ran an airplane 450 m. p. h. It was a success; but was wrecked upon landing, and no one person or combined persons have been able to reassemble the remains

The man who knows how it is done and made that machine refuses to do so again, since he wrecked himself. This motor uses no fuel but the battery and grease, no oil, gas, or fluid.

Let's get together on this for study in electricity—L. Prescott, Arizona.

BRASS TACKS

Simak has another powerful serial under way.

Dear Mr. Campbell:

Compliments are certainly due you for the fine March issue of Astounding. Especially is praise due the magnificent "Cloak of Aesir." Stuart is one of the few literary authors of scientifiction today. The scope of his imagination is superb. I had no hope for a logical explanation of the marvelous black cloak, but there was an excellent explanation given. Strange to say, my sympathy was largely with the Sarn Mother. The other characters were real, warm—Aesir? —and humorous.

Kent Casey has improved the natural and pleasant style he invented, and in his present "Star Crash" he reaches new heights of cleverness. His easy, earnest characters are a delight. My earlier opinion was quite the opposite.

Simak's new serial is truly powerful in its broad vision. The man has a whole flock of practical-sounding ideas, and the entire number of them are weaving into beautifully fine fabric, fine spun of gossamer dream webs. Your better authors have improved marvelously in the construction of character in the past year.

I hear that your circulation is now in the seventy thousand group. Keep it up there and within two years you will have no competitors. There may be magazines left—but they won't be competitors.

Try to get more variety in the lettering. All headings were alike in this issue. Attempt more on the order of that used on the jacket for "Nuisance Value." I gather that you don't like Paul, but I would like to see him once in a while. There is still too little mechanical aspect in your illustrations. Schneeman is the best in the magazine at present, and I hardly see how he can find an artistic equal in the entire field. But try Paul, at any rate.

I note that a reader praises Fearn. He *is* skillful, and almost produces literature at times, but he is trying to kid us. In one of the Mathematica stories he says—not quite the same words —"It was not so much darkness as the total absence of light." Ye gods! That nearly got me! What *is* darkness if it isn't the absence of light? Even if his puppets were characters, I could not stand that. As to his science—he even disregards *practical* science! I won't be specific; read him yourself.

That bit about the "Children of the 'Betsy B' " tickled me. When a story is that good I don't care about the scientific aspect. It was real while it lasted. I'll rank "Problem In Murder" equal to this piece. Had me dreaming of trying to hide buckets of cold dead feet all last night. Somebody kept bringing 'em back to me. I hope I never hear what Sigmund Freud has to say about that! I might be a monster! Perhaps I am.

The article "Toward the Superman" changed my opinions somewhat. I had never thought on the limitations of natural selection. Twins were born here recently with six fingers on each hand. Since they were twins, this seems to me to have been a mutation. The extra fingers were removed shortly after their birth, but if this was a mutation the defect should be inherited by a child or grandchild of either of the twins. I wonder if six fingers would be beneficial or just superfluous?—James Michael Rogers II, 2006 Court Street, Muskogee, Okla.

Explanation and Thanks.

Dear Mr. Campbell:

In connection with the short item "Our Cover" which appeared in the April issue of Astounding

regarding the Saturn astronomical cover, some further explanation is really needed. The gentlemen who aided me in looking up the astronomical reports on which the coloring of Saturn was based, and in the selection of point of view, the rather involved calculations of sizes, of what could and could not be seen, et cetera, were Mr. Arthur Draper and Mr. Hugh Rice.

These gentlemen, while associated with the Hayden Planetarium, were in this instance acting only as individuals. The Hayden Planetarium itself does, and must, deal wholly with facts; the Saturn cover is, naturally and of necessity, largely speculation. Mr. Draper and Mr. Rice aided immensely in gathering and correlating the factual data on which the hypotheses assumed in painting the picture were based, but, like science-fiction stories, the cover is, naturally, science-fiction.

The mass of information gathered with the aid of these two gentlemen probably makes the hypotheses on which the picturization of Saturn was based as nearly accurate as present knowledge permits, but, by the nature of things, it must be, unlike the purely factual material of the Planetarium, part fiction—Charles Schneeman.

Stuart, I'm afraid, has had to retire due to pressure of outside work.

Dear Mr. Campbell:

What an issue!

1. "Cloak of Aesir," by Don A. Stuart.
2. "Problem In Murder," by H. L. Gold.
3. "Follow the Bouncing Ball," by Arthur J. Burks.
4. "Star Crash," by Kent Casey.
5. "Children of the 'Betsy B,'" by Malcolm Jameson.
6. "Beyond the Sun," by D. L. James.

Stuart now has the first and second places in my private Analytical Laboratory, the above named being first and "Who Goes There?" second. Stuart has a real imagination—and he can write! The last chapter is beautifully done. This story will never be surpassed—unless by Don Stuart. Sequel, please.

Gold and Burks have fine characters in Gilroy and Josh McNab, respectively. I didn't like the first Josh McNab story at all, but the second was better. And here is the best of all, which is unusual—in most cases the reverse is true. Maybe it's because I'm beginning to understand McNab's dialect, or something.

Casey's usual breezy bit of batty buffoonery brings back the bacon. I admit to his hecklers that his stuff is not provocative of belly laughs, but even so it agrees with me. The other stories are good entertainment, although not unusually good.

So there you are. About the serial, I won't say anything yet beyond the fact that it is certainly a "super-super" type of story.

The illustrations are good, which has been a habit lately. Orban has a style as distinctive and effective as Dold's. His efforts for "Star Crash" are particularly fine. On the other hand, Binder's for "Children of the 'Betsy B'" is, although passable, not up to his usual standard. Wesso is great—but Jupiter looks badly bloated on page 45. I'll forgive him this time. Schneeman slipped on page 119, but his others are dandy. Still waiting for an artist credit line.

The cover had me puzzled for a while until it finally penetrated to that lonely brain cell of mine that it's a symbolical one, representing Aesir protecting mankind from the Sarn. I think that's it, at any rate. But don't you think it's a little too subtle? For all of that, it's a good cover.

Classified Advertising

I'm getting worried. What are you going to do with all the fine science-fiction artists you are discovering?

I'm willing to stick my neck out to the extent of saying that Schneeman's cover plate of Saturn will be the best one yet!

The articles were fair, but not nearly so good as your editorial. That hit the spot! I've been waiting for something authoritative about the electron microscope. Would it be possible to get some pictures of an atom for publication? I'll settle for a molecule, if that's the best you can do. In fact, let's have a long article on the subject with detailed descriptions, photographs, et cetera. Could atomic explosions of radium be studied under this microscope?

Let's have more of Kimball Kinnison; Karn Jones; Sam, Beltan and Kleon; Private Kelton; Gilroy, the reporter-detective; Josh McNab; and Johnny Black, Esq.

Brass Tacks is getting too little. Only nine letters this time, which is only half what there should be.

Unknown is *great!* "Sinister Barrier," by Eric Frank Russell, lives up to all advance ballyhoo. And Scott has a swell cover. You can count me as a regular reader—Robert Jackson, 239 W. State Street, Barberton, Ohio.

We'll try to make the '39 list bigger yet!

Dear Mr. Campbell:

The cover for the March number of Astounding is excellent—showy, yet not too lurid or garish. But don't carry this trend any further.

Don Stuart's "Cloak of Aesir" was out and away the best in the issue. It was better, even, than "Out Of Night." Stuart can always be relied upon to give an excellent story; in fact, he hasn't written a bad one yet.

Both science articles are O. K. by me. As for the Analytical Laboratory—well, make that score for Van Lorne's "Blue Men of Yrano" a minus twenty-four. I liked "Strange City" and "The World of Purple Light," but they were printed a year apart. The remainder of Van Lorne's work has been mediocre, and his novelette is no exception. He has a choppy, erratic style, made worse by indiscriminate peppering with exclamation points. Yes, "The Blue Men of Yrano" put over a feeling—a feeling of utter imbecilic juvenility.

As a whole, the illustrations were all right, but I think Binder's former style was better—his work for "The Children of the 'Betsy B'" wasn't anything to write home about. I liked the style of the artist who illustrated "Star Crash" and "Beyond the Sun"; I guess it is Orban's doings, but I can't be sure, as the signature is hacked off. True, book jackets for a serial are a good idea, but see that they're good ones—not like the one for "Cosmic Engineers," which looks somewhat like a temporarily stuck pinwheel.

Here's a list of the best stories of 1938, as you asked for. There's no attempt to rate them according to quality; they're all fine yarns:

"Helen O'Loy," "The Merman," "The Forgiveness of Tenchu Taen," "The Tramp," "Other Tracks," "XI-2-200," "Robot's Return," "The Disinherited," "The Terrible Sense," "Who Goes There?" "Dead Knowledge," "The Mental Ultimate," "Galactic Patrol," "Flight of the Dawn Star," "Wings of the Storm," "Three Thousand Years," "Hyperpilosity," "The Faithful," "The Legion of Time," "The Dangerous Dimension," "Rule 18."

It's a bigger list than I thought—Langley Searles, 19 East 235th Street, New York, N. Y.

The history of language shows words frequently slip from one category to another. "Human" in the noun sense is necessary, since English has no synonym and needs it.

Dear Editor:

For a month or two now I have been intending to write to you about your fine magazine.

Of course, you realize it is the best in its field, but I should like to speak especially of the art work.

The lettering of the title on the cover is in much better taste than it used to be. Furthermore, may I compliment Mr. Gladney specifically on his cover paintings. He is the only one in this field who seems to have a sense of color harmony. I no longer am ashamed to show the magazine to my friends because of the lurid cover. Now, if only the artists who do the black-and-white illustrations could develop the same convincingness! They are steadily improving, however. If you could only have them abandon the Ross-board technique occasionally—try the dry-brush method used so successfully at times, or the scratch-board technique used by the artist who used to do the illustrations for Sax Rohmer's stories. I remember the ones for "The Day the World Ended" were good enough for any artist to use as models. Oh, pardon me—I see that in two of the stories in the March issue, "Beyond the Sun" and "Star Crash" you have used the straight pen-and-ink method.

As for the literary quality of your stories, I have often wondered if you have a grammatical proofreader. For instance, I was constantly annoyed in reading "Cloak of Aesir" to find the word "human" used as a noun, instead of as the adjective it is. Outside of this minor defect, I enjoyed that story hugely. It had a quality that many of your stories lack—positiveness. For example, the continued story, "Cosmic Engineers," gets wearing on one after a time because of the continual repetition of the pessimistic note—they would never get anywhere, it was all hopeless, the difficulties were too great to overcome, et cetera. In the former story, in spite of all the difficulties, there was always a tinge of positiveness—I hate to use the somewhat vulgarized word "optimism." Another point in this story was the treatment of the love interest. It was never forced artificially into the scene. Too many stories throw a girl into the picture whether she has any logical reason for being there or not.

Your article on genetics is most interesting. Did you ever read "The Brave New World," by Aldous Huxley? If you haven't, it's a satire on what the world of the future will be like if it continues in its present direction, and carries the ideas of genetics further than most of your writers do. It also has some interesting ramifications on contemporary psychology. I'm sure you'd find it worth-while reading—Edwin Todd, Park College, Parkville, Missouri.

Simak had a reason!

Dear Sir:

This is another "first" letter to your magazine. Pause. Am I still out of your wastepaper basket? Well, anyhow, this letter is prompted by the pretty low showing "Saurian Valedictory" made in the March Analytical Laboratory. In my opinion it should have made second place, at least. Hence this letter to back up my own opinion. The stories mentioned are in order of preference.

"Cloak of Aesir" is one case where the sequel is about superior to the original story. The closing chapter is its most effective in its peculiar, dismal construction. I feel that any sequel to this story would be an anticlimax.

Incidentally, Schneeman's conception of the Sarn is much more pleasing than Wesso!

"Cosmic Engineers." I would have liked the novel much better if the universal denizens had co-operated; but I suppose Mr. Simak's reasoning is perfectly logical.

"Problem In Murder." The first time, to my knowledge, that the science-fiction fan has been dragged into the plot of a story, excepting "Air-Space" in an earlier issue.

"Children of the 'Betsy B.'" Now that you're editor of an all-fantasy magazine, you should be careful of allowing one of these to enter Astounding. No attempt at explanation was offered to explain the "Life Oil." At that, however, it was quite amusing.

"Star Crash." Casey's "Kelton" stories are his best yet.

"Following the Bouncing Ball." Burks' "McNab" stories are being run down.

"Beyond the Sun." A typical interplanetary adventure. The plant-animal idea, however, raised it quite a bit.

The general impression I gathered from this issue is that you're trying to reach the March, 1938, standard—my idea of near perfection—and not coming so terribly short of the mark, either.

The cover was not up to the standard the two other new artists set. How about having Frew back? Only on the cover, though. The other illustrations are exceptional, except for a few poor ones on pages 57, 95 and 109.

Before I close this letter I'd like to give my idea of the best stories of 1938. You notice they are *my* idea. Others may disagree—not violently, I hope.

"The Master Shall Not Die," "Who Goes There?" "Hyperpilosity," Dead Knowledge," "Red Heritage," "Wayward World," "Something From Jupiter," "Legion of Time," "Seeds of the Dusk," "Orbit XXIII-H," "Other Tracks," and "A Matter Of Form."

What will be your next astronomical cover? I think you've exhausted all those you could do with any accuracy to detail—Sam Yampolsky, 240 Austin Street, Winnipeg, Man., Canada.

Why should Jovian vines be more potent?

Dear Mr. Campbell:

I've just put down the latest Astounding with a shudder. I think that from the feeling of the weather outside somebody's dropped the Cloak of Aesir around Waterville. But this isn't a dissertation on the weather.

After reading carefully through the March Astounding I just had to write. "Cloak of Aesir" made writing impossible to resist. I dunno why I liked it, but it rates five—yes, 5—plums. There's something to it that stands it head and shoulders above any other story in the issue. Almost above any other story in any of the copies I have read yet.

"Problem In Murder" was good; dropping down to three plums. I liked the clever idea; although I actually suspected it from the very beginning of the plot.

"Follow the Bouncing Ball" was good; as other Josh McNab stories are. I'll give this one three, too. The cushion shot he played off Parson's dome was *ver-ry neat.* Tell Burks to teach me that one, will you? There's a guy here I'd like to try it on.

I think Casey outdid himself a little on "Star Crash." Much better than the run of Kelton stories so far. Two and a half.

But this one! *Phew!* Implausible, even with the dialect. By gosh, when my canoe grows up into a dory, I switch to Coca-Cola! If Jameson made his "vines" a visitor from Jupiter, or somethin', it *might* be somewhat better, but it plain stunk. One—*seed.*

"Beyond the Sun" rates two plums, though. The mice-men would make good playmates to the owl-eyes. (The fellows in Casey's story, I mean.) But I get thirsty every time I think of this one.

Four plums and a half to Chapter II of "Cosmic Engineer." This serial will rate five yet if the last one is as good as this one. The first installment wasn't quite as good, but there is still hope. I've finally found a story that really gives my brain something to do. (Wait'll I read the famous "Galactic Patrol," of which I have a copy now. Then we'll see.)

I don't know just how to rate the articles, but the editorial, "Apologia," gets three and a half.

But I have a kick. Brass tacks is too small. Not enough in it. Of course, I realize that space is limited, but you could have left out that insipid "Children of the 'Betsy B'" and printed

some Brass Tackers with great profit. *I* think. Mebbe I'm wrong.

Well, before I go to sleep here, I'll rate them in order for you.

1. "Cloak of Aesir"—Stuart—5 plums.
2. "Cosmic Engineers"—Simak—4 plums.
3. "Apologia"—Campbell (?)—3½ plums.—Editorial.
4. "Follow the Bouncing Ball"—Burks—3 plums.
5. "Problem In Murder"—Gold—3 plums. (Maybe this one should have been above No. 4, but they tied, so who cares?)
6. "Star Crash"—Casey—2½ plums.
7. "Beyond the Sun"—James—2 plums.
8. The cover illustration—Gladney—1 plum.
9. *And last*—"Children of the 'Betsy B'"—Jameson—1 SEED.

(Or should it be prune? No, a prune is wuth more than a seed.)

According to my weak math, this makes the issue as a whole figure up to about three plums average—and that's good, the way I rank 'em! I counted the seed as zero, for any of you mathematicians that wish to check my figures.

And in closing I holler long and loud, "Bring back Wesso on the covers!" How about it, folks? —Gerald B. Clarke, 272 Main Street, Waterville, Maine.

Josh McNab coming next month.

Dear Editor:

Herewith my comment on the March Astounding.

Front to back—cover first: This new man, Graves Gladney, is a *good* artist! From the slight available evidence it would appear that he is not experienced in the field of fantastic fiction illustrating, but we like his humans. It makes a nice-looking cover, but—the cloak should have been dead black and opaque instead of translucent blue, and the figure of Ware—Aesir —should have been concealed by it.

Regarding the story, "Cloak of Aesir," the original Aesir story was the poorest excuse for science-fiction I've seen in our magazine for some time, but this sequel clears up all the unexplained vagueness of the original, and goes on to become a really interesting bit of science and adventure. You're right in there batting, "Don." The atmosphere and civilization of the Sarn Mother give an interesting background for the action.

I notice a marked change in the illustrations of this issue, as compared to those of three months ago. First, the full-page "story openers." I much prefer the type of illustrating done for "Cloak of Aesir" or "A Matter of Form." The opener is three fourths page—much better, for it allows the story to start on that page. Then the small pictures throughout the story and, finally, the double-page spread. The other full-page openers in this issue seem to waste a lot of valuable space, and they're not especially good pictures, either. Don't give us a "melange" or an "impression"—give us the good, sharp, photolike pictures such as Wesso's work for "Cosmic Engineers."

Burks' "Josh McNab" story and Casey's "Star Crash" tale were two more welcome entrants in the "come-back" classification. Both were good. And the "Betsy B" Story—an idea amusing and unique. The serial, "Cosmic Engineers," is moving upon a truly huge background. The author does not have the complete mastery of his ideas and subject as has, for instance, E. E. Smith, but, although he does not "project" the grand sweep of the universe, he seems to be having fair success in cutting around the edges.

On the subject of your "Apologia"—by the way, the information on the electron microscope was interesting—I have, for some time, had the same opinion. Science-fiction, no matter how far-fetched it seems to some of us, would seem but the feebly constructed air castles of a child, if we should be privileged to have a glimpse at the manifold wonders of science and truth. In spite of the seemingly unbounded imaginings of our authors, "Truth is stranger than fiction"—even fantastic fiction—L. M. Jensen, Box 35, Cowley, Wyoming.

Brass Tacks with a sharp point!

Dear Editor:

The new authors you introduced during 1938 are not good enough for Astounding Science-Fiction. Why did you publish rubbish like "Ra for the Rajah," and "Anachronistic Optics"? Please give us stories by the old authors.

There were very few drawings by Wesso and Dold during 1938, while too much rubbish was accepted from those cartoonists, Orban and Binder.

I end this letter by hoping that you will improve during 1939 and again reach that high standard which Mr. Tremaine attained just over one year ago—Robert E. Mildren, 188 New North Road, London, N. 1, England.

Review of 1938.

Dear Mr. Campbell:

This letter, on the verge of being begun for more than a year, is finally being written in response to your request in *Brass Tacks* for a list of the three top yarns of '38. Had you asked for the best eight, or perhaps the best ten stories, this task might have been made easier; for that of selecting the trio of ace yarns calls for close decisions.

To my mind, the first half of the year brought the majority of the stories that were really good. "Dead Knowledge," in January, for instance, packed a style and mood that, with a less conventional ending, might have been the top story on my list. "The Master Shall Not Die," and "Flight of the Dawn Star," in March, both rate with the top ten; but again because of lack of originality, a story—the latter—is excluded from candidacy in this contest. June brought three very good tales: "Seeds of the Dusk," "Men Against the Stars"—one of the top three—and the conclusion of "Three Thousand Years!" which I thought on a par with "Rebirth," by the same author, probably because I don't consider the latter to be the classic most fans term it. And then in August was "Who Goes There," a long story maintaining a suspense not often found in science-fiction.

By elimination, my choice for the best three of last year is as follows:

First place, "Who Goes There?" by Don A. Stuart, whose masterpiece, "Forgetfulness," was my choice for the best of '37.

Second, "Men Against the Stars," by Manly Wade Wellman, a story that, aside from scoring high with most fans of my acquaintance, I imagine did a lot for interesting new readers in Astounding.

And third, I place R. DeWitt Miller's excellent treatment of an old theme, a true *Nova*, "The Master Shall Not Die."

It is to be noted that the majority of "Galactic Patrol" having appeared in '37, I have omitted it in considering the stories of '38.

In Astounding's latest, the February issue, Jack Williamson's yarn, "Crucible of Power," ranked higher with me than have any of his stories in the past several years. The reason for this is the absence of that fantastic sort of pseudo-science with which he has recently promiscuously flavored his work.

The semislick paper you've been using for a few months is a commendable innovation, but I would appreciate your putting it to better use by letting Wesso and Dold do the greater lot of your illustrating.

Incidentally, *Unknown* looks very good, but I haven't as yet read it—Roy A. Squires, 1745 Kenneth Road West, Glendale, Calif.

For the readers:

Dear Mr. Campbell:

I think the readers of Astounding will be interested to know that there is a regular amateur newspaper published every week, giving them news of science-fiction. The paper is published every Saturday and contains four pages, eight and a half inches by eleven inches, mimeographed on white paper. We publish regularly, news of forthcoming yarns of *all* the science-fiction magazines. We were the first to announce Astounding's companion magazine, *Unknown*. We were also the first to announce the new cover artists and other changes of Astounding. Besides giving you beforehand information on American and British science-fiction magazines, we give you data on science-fiction yarns published in adventure and other non-scientific magazines. We know that some of you would like to read the scientific stories that appear in other than the scientific magazines, but not knowing when they are published, you miss them, so hence we make it a habit to announce them. We give you also the story ratings of *all* the scientific magazines. Aside from the professional field, we publish complete information on the doings of the scientific fans and their magazines. We review all the *worth-while* amateur fan magazines published. Also included every week is a column on science-fiction movies by Mario Racic, Jr., called *Scientifilms*. If you are a scientific fan that is deeply interested in science fiction and would like to know the inside workings of this interesting subject, you'll enjoy reading this weekly. The name of it is *Fantasy-News* and sells for the low price of three issues for ten cents. As an added attraction we publish a number of supplements among which is *Fantasy-Scout*, which is a four-page monthly of scientific articles, fiction and interesting items by both fans and professional writers. The supplements are, of course, published FREE to all subscribers. Send in a dime or *Fantasy-News* today—James V. Taurasi, 137-07 32nd Avenue, Flushing, New York.

Old-timers.

Dear Mr. Campbell:

Here is how I rate the stories for a vote in the Analytical Laboratory:

"Follow The Bouncing Ball." The best of the McNab stories.

"Cloak of Aesir." This story is dragging out too long, but it is very good. Hurry up the sequel.

"Children of the 'Betsy B.'" One of the better of the "slightly screwy" stories.

"Star Crash." Good, even though the interplanetary adventure base is tiresome, and has been for a long time.

"Problem In Murder." Not bad, not especially good.

"Beyond the Sun." A good-enough story, I suppose, but I did not care for it especially because of the reason mentioned under "Star Crash."

None of the stories were really bad, and most were good.

Why so darn many new cover artists? This month's cover to me was not so good. Get Wesso and Brown back on the cover. For some time now there have been those clamoring for a cover from Dold—how about it, ed?

Stop tantalizing us, Mr. Campbell, and give us all smooth paper.

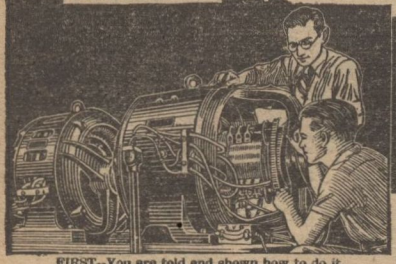
I hope that your new duties as editor of *Unknown* will not hinder your work for my favorite, Astounding.

I am inclosing a list of authors who wrote a few really good stories and then disappeared. I would like to see them back.

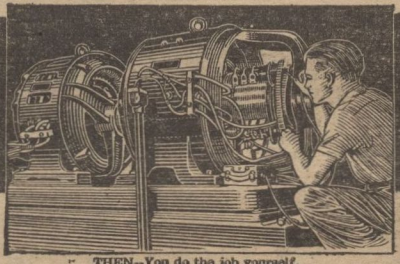
W. K. Sonneman, Laurence Manning, Festus Pragnell, J. W. Skidmore, and, oh, well, I could go on forever. Couldn't you get in touch with some of these authors and see whether they could still produce some of the material that made such a deep impression on so many of us?—D. P. Bellaire, 684 Royce, Altadena, Calif.

QUICK, EASIER WAY TO TRAIN FOR ELECTRICITY

12 Weeks *Practical* WORK IN MY CHICAGO SHOPS



FIRST--You are told and shown how to do it.



THEN--You do the job yourself.

WANT TO EARN MORE MONEY?

Have you ever dreamed of holding down a steady, good pay job? Have you ever dreamed of doing the work you really like in a job that holds promise of a real future in the years ahead?

Well, we all know that you can't get the good things in life by just **dreaming** about them. Hundreds of fellows are today holding down mighty fine jobs with prospects of a bright future. They are filling these jobs because they had the foresight to equip themselves with the **right kind of training.** Most of these men were only average fellows a short time ago, but the proper training helped to lift them out of the low pay ranks of unskilled workers. The same opportunity is now offered to **you.**

The great fascinating field of **ELECTRICITY** offers a real future to many men and young men who are willing to prepare for a place in this giant industry.

Here at my school in Chicago, the **world's Electrical Center,** you can get **12 weeks' Shop Training** in **ELECTRICITY,** that can help give you your start towards a better job.

You will be trained on actual equipment and machinery and because of our method of training, you **don't need previous experience or a lot of education.** Many of my successful graduates never even completed Grammar School.

Here in my school you work on generators, motors, dynamos, you do house wiring, wind armatures and do actual work in many other branches of electricity and right now I'm including valuable instruction in **Diesel, Electric Refrigeration** and **Air Conditioning** at **no** extra cost. Our practical shop methods make it **easier to learn—First** the instructors **tell** you **how** a thing should be done—**then** they **show** you how it should be done—**then you do the actual work yourself.**

"... Everything was just as stated in literature. And by Coyne methods plenty of instructors to take care of everything. easy to learn. I really was satisfied with Coyne Training." J. Halyk, Canada

"... Coyne has first class instructors to teach you the simplest things to start with and they have the equipment to show you these things as you advance..." Ben Rickman, S.Car.

I'LL FINANCE YOUR TRAINING

You can get this training **first**—then **pay for it later** in **easy monthly payments,** starting **60 days** after your 12 weeks' training period is over **—then you have 12 months** to complete your payments.

If you need **part time work** to help out with expenses while training in my shops, my employment department will help you get it. Then after graduation this department will give you valuable **lifetime employment service.**

Send the coupon today for all details. When I get it I'll send you my big free book containing dozens of pictures of students at work in my shops. I'll also tell you about my **"Pay After Graduation" plan,** how many **earn while learning** and how we help our students **after graduation.** Fill in, clip coupon, **mail today for your start toward a brighter future.**

MAIL NOW

H. C. LEWIS, President

COYNE ELECTRICAL SCHOOL

500 S. Paulina St., Dept. 49-98, Chicago

H. C. LEWIS, President,
COYNE ELECTRICAL SCHOOL,
500 S. Paulina Street, Dept. 49-98, Chicago, Ill.

Dear Sir: Please send me free your big catalog and full particulars of your present offer, also your "Pay-Tuition-After-Graduation" Plan.

NAME.....

ADDRESS.....

CITY..... STATE.....

NEW! Lee COLOR-MATCHED SHIRTS AND PANTS

Style ★ Comfort ★ Long Wear!

For Vacation, Sport or Hard Summer Work

...you'll find Lee Color Matched Shirts and Pants can take it!

Genuine Agan Jeans, Treg Drills and Twills are exclusive Lee fabrics in both weave and dye. They're fade proof, Sanforized-shrunk—then *tailored to fit.*

Remember, Lee combines style and comfort with rugged wear. Twelve popular shades—sage green, dusty green, livery green, forest green, sun tan, smoke tan, marine tan, powder blue, navy blue, shantung, sand and white. See your Lee dealer or mail coupon.

GENUINE LEE TAILORED SIZES

A Perfect Fit for Every Build

Lee Color-Matched SHIRTS & PANTS Sanforized-Shrunk

FREE! Mail Coupon for Fabric Swatches

The H. D. Lee Merc. Company, Dept. AF-5
Kansas City, Mo.; Minneapolis, Minn.; Trenton, N. J. South Bend, Ind.; San Francisco, Calif.; Salina, Kans.

Send me Lee color-matched, color-fast fabric swatches—also name of my nearest Lee dealer.

Name_____

Address _____

Town _____ State_____

The Right Combination does it...

THE SECRET of Chesterfield's milder better taste...*the reason why they give you more smoking pleasure* . . . is the right combination of the world's best cigarette tobaccos rolled in pure cigarette paper . . . the blend that can't be copied.

Chesterfield

THEY SATISFY