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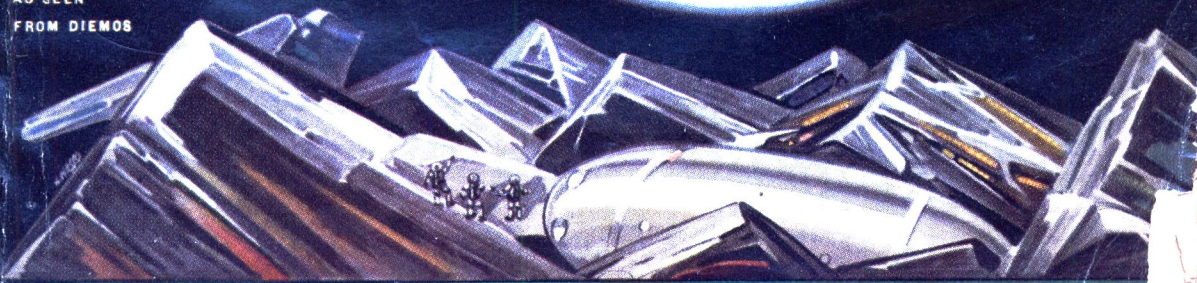
JUNE 1938

ASTOUNDING

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BY MANLY WADE WELLMAN

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Volume XXI

Number 4

JUNE, 1938

A Street & Smith Publication

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- MEN AGAINST THE STARS** Manly Wade Wellman 6
Men died on the altar of science—red fire-crackers in space—as every famous man of rocketry had died—short of his goal!
- SEEDS OF THE DUSK** Raymond Z. Gallun 76
A tale of the days when Earth has grown old and cold, and the least of her children are keeping their wits for survival—

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- BELOW—ABSOLUTE!** Harry Walton 22
Into the Pit in space—a blackness colder than absolute zero! A sequel to "Quicksilver, Unlimited."
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An inverted world where the planet was protoplasmic flesh—and intelligence resided in the mobile stones!
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The tale of a tiny, hidden empire on Earth—an empire that would not be known.

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The Legion of Time reaches Jonbar—city of the might-be future—to have it dissolve away in mist of probability about them!
- THREE THOUSAND YEARS! (Conclusion)** Thomas Calvert McClary 110
Gambie, the perfectionist, and Drega, recognizer of human imperfections, reach at last an understanding—and a new reversion.

Science Feature Articles:

- THE GREAT EYE** R. DeWitt Miller 54
A fact article on the 200" telescope and its possibilities and limitations.
- WITNESSES OF THE PAST** Willy Ley 136
Concerning Platypus and others that lived when they shouldn't have—and gave naturalists headaches and heartaches!

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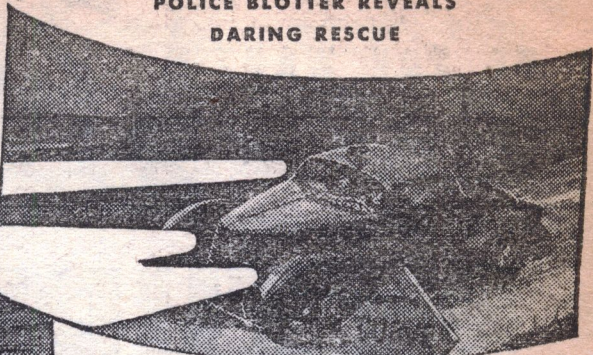
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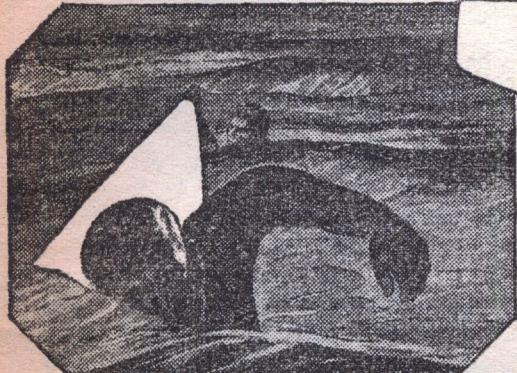
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Patrolman Ernest Saftig, former life-guard, of 4487 47th Street, San Diego, California, whose courage and presence of mind snatched the life of a reckless beach-party swimmer from the sea.



"It was 2:30 A.M. The radio in our car barked our number, 'Crystal Pier, a drowning, rush.' From the pier, my partner, Richard V. Disney, of 3230 Whittier Street, and I, heard faint cries,



"When I reached the man he was about done for. As I battled the undertow to bring him in, he slipped from my grasp and sank.



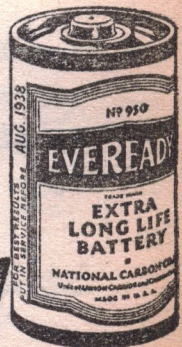
"In the darkness I couldn't find his body. Then Disney gave me his flashlight, and because it kept burning, I was able to locate the victim by diving.



"Together, Disney and I brought the body ashore, and then...

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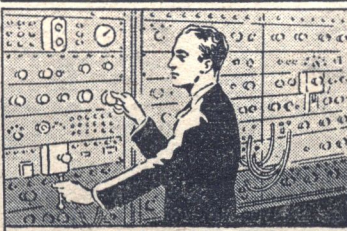
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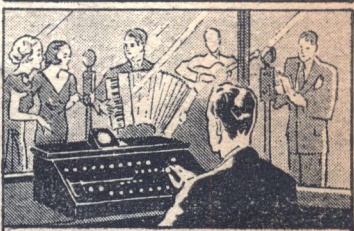
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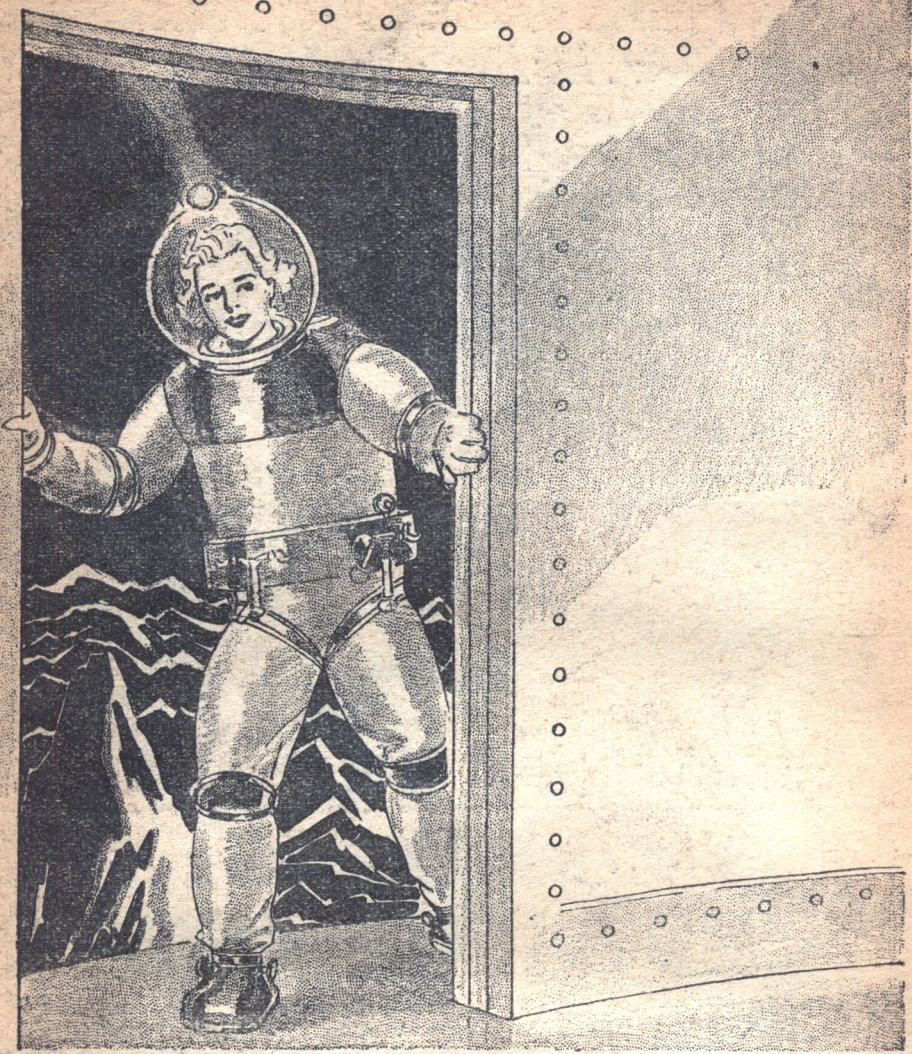


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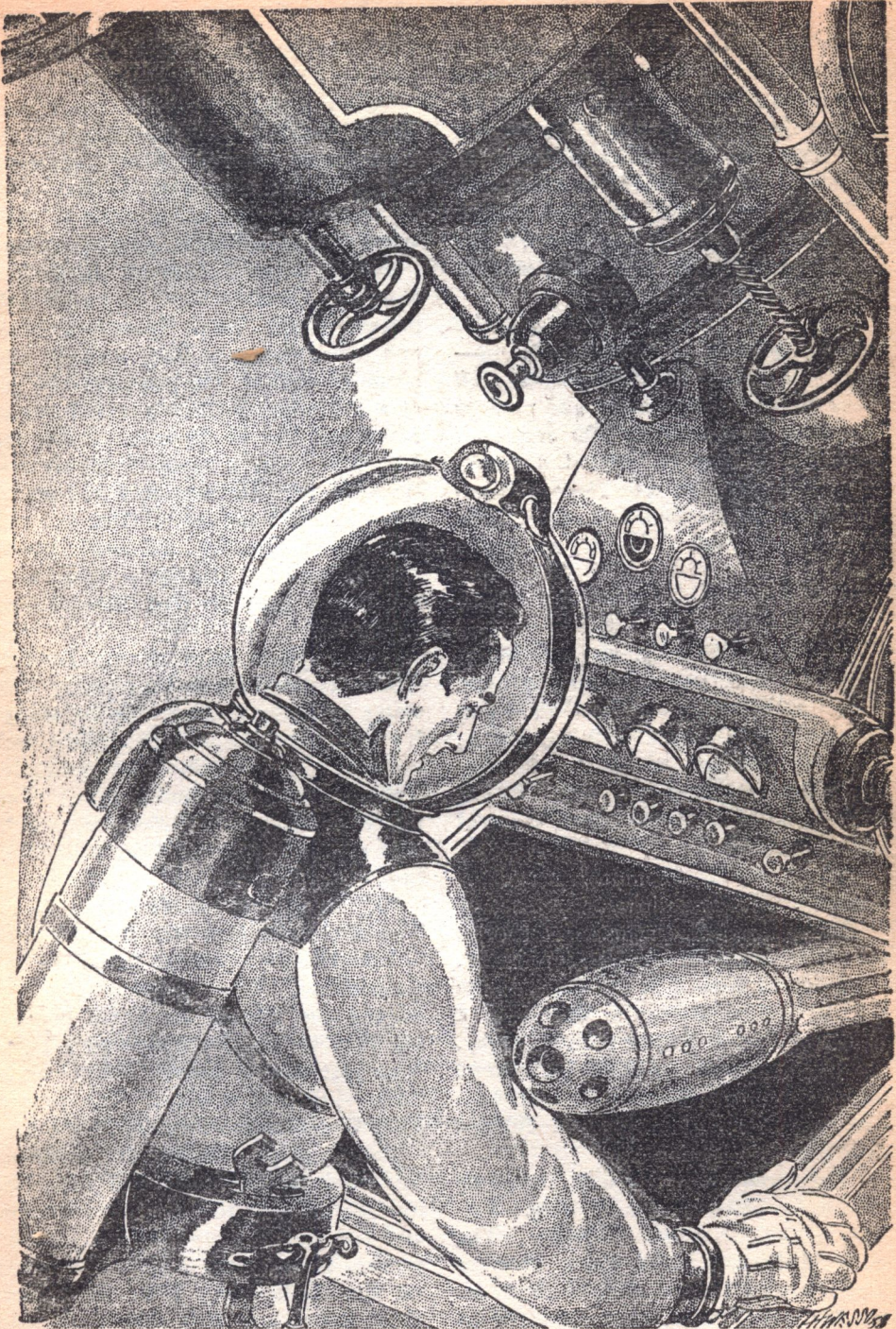
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Men Against The Stars

By Manly Wade Wellman

Human courage and a hard-hearted idealist—against the challenge of the stars and red firecrackers in space.



He was engrossed, watching that mutinous ship that had turned back on its course to Mars. He did not notice the dark figure that had entered the airless observatory.

In ship No. Fifty-one, half-way from Moon to Mars, four stubbled faces turned to a common, grinning regard as the pounding roar of the rockets died away at last. The skipper, the rocketman, the navigator, the spacehand.

"So far so good," said the skipper grimly. "We've reached speed. But the fuel may decide to go any minute. And that'll be—that."

Even as he spoke, the fuel—frightful unstable solution of atomic hydrogen—went. Four men—the flimsy metal shell—the hopes, determination and courage that sought to conquer the stars—all were gone. For an instant a warm, ruby glow, sprinkled with stars of incandescent metal, blossomed in space. The men did not mind. They did not know.

I.

TALLENTYRE watched Major DeWitt step through the door. DeWitt closed the door. Immediately he slumped back against it, his body drained of some stiffening thing that had held him up. But for the support of the door frame, he would have fallen.

"They won't go," DeWitt said harshly.

Tallentyre looked at him with wooden, unmoving face. If he moved his face, if he moved himself in the slightest, he felt, he would shatter to dust, like a scratched Prince Rupert's Drop. Gray, bloodshot eyes in his lean, high-boned face watched his superior motionlessly. The leathery skin of his face did not move.

"They won't go." DeWitt looked up at him, his blotched face working. Tallentyre noticed it was hideous. The unshielded sunlight of space here on Luna tanned human skin black in irregular spots. The untanned spots on DeWitt's face were white as paper, and they wiggled.

Tallentyre sighed sharply, and moved.

His gray eyes were cold as fractured steel as he watched DeWitt.

"They won't go—and I won't send them!" DeWitt straightened against the door frame and glared at Tallentyre, daring him to challenge the statement. "I can't—I won't let them!" His voice rose to a hoarse, grating scream.

Major John Tallentyre faced him stonily. Outside lay the rock-and-pumice paved Luna Spaceport, black and silver under shifting sunlight and shadow. Above, the star-spattered jet of the Eternal Night. The red eye of Mars was low in the east. Tallentyre looked at it for a moment, quietly and thoughtfully. He was cold and icy as the spaceways out there. He, too, was burned to the patchy blackness of space-sun exposure. His gray eyes were startlingly light in that sun-scorched face.

"Keep your voice down, DeWitt. Those mutineers will hear you. You won't build up their morale by shouting that yours is shot. Straighten up."

DeWitt shook his head groggily. Tallentyre was his junior here. For a moment, the slap of Tallentyre's words shot an anger into him that half-roused him, as had been intended. But it faded.

"I," he grated, "don't give a damn. I want them to hear me. I won't send—I won't let—any more human beings go into *that*." His arm gestured weakly toward the starred blackness beyond, his face working. "Fifty-One's gone. You just saw it blow. Those—mutineers—just saw it blow. The men in Fifty-One though—they didn't see it.

"Sixty ships, Tallentyre. Sixty of 'em—and two hundred and forty-two men started from Earth. Fifty-six ships, and two hundred and twenty-two men reached Luna Port. Eighteen men lost on that little hop. Four ships blew their tubes—and that bloody six-man experiment first of all.

"But fifty-six ships landed, and we warped 'em off to Mars. And how

many of those fifty-six got through?" His grating scream roared in the cubby-hole office and pounded through its flimsy metal door. Tallentyre's eyes moved toward the door.

DeWitt's roar dropped to a whisper as the man leaned abruptly forward, close to Tallentyre's moveless, sun-blackened face. "Four. Four got to Mars, my friend. The rest were pretty, red firecrackers in space."

HE STRAIGHTENED slowly from the table, hunching his baggy, greasy uniform back over his shoulders. "I'm in command of this altar of human sacrifices they call Luna Port. And there aren't going to be any more sacrifices!"

Tallentyre's eyes stared into his steadily. "You knew men were going to die when you swore to take this duty, DeWitt," Tallentyre said steadily. "And you swore to uphold your trust. Keep your voice down, please. We'll reason with those mutineers."

DeWitt shook his head. His eyes were blazing now with a new determination; the gray-and-black mottling of his face had given way to red-and-black, as willess despair gave way to a different fanaticism. "No!" he roared. "We'll send 'em—but we'll send 'em back to Earth, where men belong. Duty? Duty hell! I'm not, and will not be, High Priest of human sacrifice. *Those ships don't go.*

"And the spineless slugs back on Earth that tell 'em to do things that can't be done can come and try it if they want. I'm going to tell those men right now——"

DeWitt swung round and started toward the thin metal door with fanatic stretch of stride. Tallentyre leapt to his feet and gripped DeWitt's arm.

"Wait," said Tallentyre.

"Wait for what?" DeWitt sneered, and threw back his head to laugh harshly.

For an instant Tallentyre watched

him. Then his fist moved in an invisible blur. DeWitt slumped easily, tiredly, to the floor under Luna's light pull.

Tallentyre stood for an instant above his fallen superior, the same wooden, moveless set to his lean, leathery face. Then abruptly he trembled, and fell awkwardly beside the fallen man to listen for an instant to his strongly beating heart.

Shuddering, he rose to his feet and looked desperately about the room. A relaxation, from without and within, flooded over him. His eyelids fluttered; he had to bite his lip to keep it from twitching. He slumped back into the desk chair and let his arms hang limply down beside him, staring at the fallen man.

Finally he spoke, very softly, to himself. His eyes were fixed out beyond the double-glass window of the tiny office. Beyond, where the space-black-and-silver of the spaceport blended with the black of space and the silver dust of stars. Mars, a ruby on jet velvet, lay over the horizon—the cruel, jagged horizon of Luna. "Thanks, DeWitt. You—you made me hold together.

"Altar of human sacrifice——? So was Nevada Port once. But they reached the Moon. Before that—for centuries before that—the air was the Altar of Sacrifice. But those men that died in the air weren't seeking air. They sought the stars beyond. They didn't die on the way to the Moon. They died on the way to the stars. They aren't dying now to reach Mars; again they're seeking the stars beyond. Someone's always had to——"

He looked up abruptly. The door on the other side of the office creaked softly. The frightened young face of Noel Crispin, the blond girl who kept the office files, looked in. Her eyes changed as she looked at Tallentyre and then at DeWitt.

"Take care of Major DeWitt," or-

dered Tallentyre of the moveless face. He slipped something from the desk drawer into his pocket and rose. "I've got to persuade the boys in the vestibule." He crossed the office in three long strides. His steadiness was back entire when he turned the knob; he stepped into the outer room with an air, almost, of insouciance.

FOUR MEN dressed in the rubberized canvas of spacehands stood together in the middle of the vestibule floor. No doubt they had heard most, if not all, of what had passed in the office. Tallentyre looked at them. Two were huge and burly, tough, hard-shelled men who'd try anything once. Two were of a different breed; two who would do anything, at any risk, for some things, things in which they believed. The biggest, the toughest, wore a golden comet. The skipper.

He wasn't afraid now. He'd simply detemined the odds were bad, and he wasn't having any. The other burly figure looked up to him; what the skipper said was right with him.

The two leaner, wiry men were white-faced. Nerve-shock release was their trouble. Like plane-pilots who'd lived through a crash, they were afraid of their fire-ships. The psychology of the things preyed on them. Nobody had ever been injured in a rocket accident. Nobody, ever. They landed sound—or simply weren't.

They'd landed. They couldn't, now, face the thing again. But, like the plane-pilot who'd survived a crash, once started again they'd be all right.

"In six minutes," said Tallentyre, "Sixty-One takes off to Mars."

"We're not going," said the skipper. "We told DeWitt that."

"You volunteered," reminded Tallentyre.

"We didn't know what we were tackling. Only ten ships had tried then, and two had gotten through. Now we

do know. The trip from Earth to this hole—not three hundred thousand miles—was enough. It wasn't carelessness that snapped those other ships. We know. It was rotten tubes and rotten fuel. I drove a nitro-wagon in the oil country and felt safe. But not on this buggy. Nitro's baby's milk to this stuff. Atomic hydrogen!

"Hu-uh. We don't go." He looked at Tallentyre coldly. He meant what he said, and meant to stick with it.

"I SUPPOSE there's no use," said Tallentyre woodenly, "to say anything about guts and keeping a promise and how much you men mean to this thing. If you don't go, you know, others won't."

"Guff," grunted the skipper. "It isn't any use.

"I call this mutiny," Tallentyre informed him.

"Call it whatever you damn well like," growled the skipper. He looked down at the slighter figure of the Spaceport official challengingly. "We don't blast. And there's no sense chucking your rank around, either. There's four of us. And just what in hell do you call it when you klunk out your chief, eh?"

Tallentyre's right hand rested easily in the pocket of his tunic. The cold, gray eyes watched the big spaceman steadily. "You think you could get away with violence?"

The big man took a step forward with a hamlike fist clenched before him. "Think, brother? Hu-uh. I *know* I can," he said softly. "You tried it yourself inside there." Without turning his head, he spoke to the men behind him. "Come on, boys. Grab this guy. And one of you tail for the ship and that gun."

Without relaxing his moveless, wooden face, Tallentyre drew his hand from his tunic pocket. Space volunteers have to have a queer, reckless

courage. With a bull roar, the giant catpaw dove forward with outstretched hands, his face twisted with sudden hate.

Tallentyre shot him between the eyes. The big body fell with exaggerated slowness under Lunar pull.

The roar of the heavy weapon drowned the sudden, soft cries of the other three. Tallentyre eyed them coldly, his face unchanged. The other burly man looked confused and bewildered, his eyes fixed muddledly on the fallen leader. He looked around toward the lean, white-faced youth with red hair and startling blue eyes. The other spacehand was looking at him, too, for encouragement and decision. He swallowed raggedly.

A new, terrific tension had built up. It reduplicated, somehow, the tension that had made bearable that trip from Earth. The redhead shrugged, and a wry smile twisted his lips. "I guess I'll go, sir."

Tallentyre's wooden face relaxed. "Good. She's your ship then. You're the skipper. Your name? Joe? All right, you go in five minutes. This man was your rocket expert, I think? You won't need him, or a replacement. You have a navigator, and a couple of hands. Go to it."

Five minutes later, Tallentyre watched Joe seat himself in the pressure chair in Number Sixty-One's central cabin. He waved once, with a white-faced grin that made it seem he liked, but feared this command of his. Then the metal shutters came up over the rocketship's tough windows. A smooth, metal shape screamed soundless fire into the vacuum that wrapped Luna. The rushing, ruddy gas-streams scoured the pumice of the spaceport field. Number Sixty-One shot out toward Mars.

II.

TALLENTYRE sat motionless in his office, his face somehow disconnected

from his mind, betraying no hint of what went on behind it. Number Sixty-One. It might get there. Four had, already.

But if it didn't——? None of the great of rocketry had gotten where they had hoped to land. That other Joe, that great Joseph—Joseph Moessner. He'd sought the rocket fuel that would take him above the stratosphere. He'd recognized the inadequacy of hydrogen-oxygen. It was too heavy. The hydrogen was light enough as fuel. But for every 2 pounds of hydrogen, 16 pounds of oxygen had to be used. If only hydrogen would burn alone——

It would; Moessner had known that, and he'd done it. Hydrogen gas is H_2 —two atoms combined. Monatomic hydrogen—atomic hydrogen, so-called—would burn with itself to produce diatomic hydrogen gas, and enormous heat.

Old Moessner had been right, and he'd seen the way; stabilize the monatomic form in some solvent. He'd even found the solvent.

But he never found the top of the stratosphere. For the solvent didn't stabilize the frightful stuff sufficiently. He and his two assistants—when they'd made nearly twenty pounds of the saturated fuel—became particles almost as fine as hydrogen atoms themselves.

No rocket man had ever reached the goal he sought, himself. But others took hold where Moessner so decisively left off. Less disastrous experiments showed that the combustible, oillike solvent Moessner had used could be modified just a trifle, and made more stable. The saturated stuff generated power eleven times greater, weight for weight, than did the oxy-hydrogen fuel. They had *moessernol*. The rest was trial and error—and death.

The first passenger-carrying rocketship to pass the stratosphere exploded fifty miles above Earth's surface. The

trouble, investigation showed, was in the metal of the tubes. In 1961 Moessner's younger brother set out for the Moon. He didn't reach his goal, but astromers saw the red flash of his explosion a scant 100 miles from the Lunar peaks. None of the great of rocketry ever quite got there.

Others, in better craft, survived later landings. At first they didn't come back, though. Then the World League, having settled decisively the question of international peace and trade, took interest in rocketry.

Money, now, and Moon-trips became regular and generally successful. The new Rocket Service prepared to accept the challenge that must be answered—Mars. The Moon, with one-sixth Earth's surface gravity, and with less than 1/80th Earth's mass, was obviously the stepping stone and refueling station for Mars.

In 1996, Luna Spaceport was constructed. In 1997, Major DeWitt was placed in charge—and Tallentyre had been second then.

Twenty-eight ships that year. All that were left of the thirty that set out from Earth to Moon. Two landed on Mars. Horror crept down the tubes of the telescopes that watched from the airless Moon. Red firecrackers in space, two—three—five had gone. Then one landed. Then another! Then—but it missed. The rockets blasted in a long, circling trail as the radio signals faded away. The control mechanism was gone. Frantic voices that became thin and died.

Firecrackers and dancing mice with long red tails. And no sense of direction.

1998 now. There were to be thirty-five ships this year. Two ships had landed of the first thirty. DeWitt had stood that, silent and moody as ship after ship flashed bright red and vanished. Or danced its brief, whirling waltz of death. There were fewer

dancers now; in that year they'd done a lot with control mechanism. In the last twelve ships, there'd been no wanderers. But they cracked for some reason no man could say. Tubes or fuel? Only the wreckage might have told, and that—

That was shining droplets spattered through space.

The rebellion this day had finished DeWitt. It had near finished Tallentyre; only DeWitt's failure had forced him to defense. Tallentyre took over.

He made entries on the log as the dwindling ruby of Number Sixty-One vanished outward in space.

"What a cinch to run that Luna Port!"

Five days out in space, Mars bound, the crew of Number Fifty-Nine was exercising the age-old privilege of able workmen to belittle superior officers.

"DeWitt! Tallentyre!" growled the engineer. "Who are they but a couple of straw-stuffed uniforms in a soft job they got by a hefty pull? They sit back there with their feet on desks, while we're gunnin' out here, out where the danger and the work is." He spat into the waste container.

"Oh, I don't know," temporized a spacehand with an ambition to be an executive. "They've probably got worries of their own."

Worries of their own?" echoed the engineer. "On that button-pusher's work? Say, if either of them ever worried a day of his life, I hope this ship blows apart right no—"

Number Fifty-Nine was rose-red flame and sparklets of incandescent metal in that instant.

Number Fifty-Nine was one of Tallentyre's worries.

CONSCIOUSNESS returned slowly to Major DeWitt after Tallentyre's blow.

He found himself dragged into the record room, and Noel Crispin ministering to him, as Tallentyre had ordered. He sat up, pondered blackly for several minutes, then went into the office. Without addressing his colleague, he sat before the radio, tuned in Earth, and told the secretary of the Rocket Service Board that he was resigning, to take effect immediately. After some time there came back a tentative acceptance, with the additional information that a ship would arrive to carry him away. In the same message, Tallentyre was ordered to take command at Luna Port.

DeWitt went to his quarters and locked himself in.

Tallentyre called a pair of men from the machine shop, consigned the body of the dead rocket-skipper to them, with directions that it go back to Earth when the ship arrived for DeWitt. Returning to the administration office, he sat down before the screen that recorded telescope views. After some correction of angles and focus, he picked up a clear rectangle of black, starry sky. In the center hung a cartridge-shaped hull—the last ship to leave the port.

Small in the sky beyond, a lesser capsule of metal was visible.

"A ship heading back?" muttered Tallentyre to himself. "More mutiny?"

Wearily he decided to deal with the case as it matured. His present attention must be concentrated on the craft so recently launched.

Leaning back in his chair, he fumbled the radio into operation. "Hello, hello," he said. "Ship ahoy, Sixty-one!"

"Hello, sir," came back a voice he knew—Joe, whom he had appointed captain.

"What goes on, Joe?"

"All well, sir. I'll drop you a picture postcard from Mars."

"See if there are gondolas on the canals."

Laughter from the radio—healthy laughter. "This isn't as bad as I thought it'd be, sir." Then, in sudden alarm: "Hey! Something's going bad! Looks like——"

The view on the screen suddenly flashed into white fire, blinding the observer. At the same instant something roared in the radio, then broke off. Silence, while Tallentyre clasped his hands to his tortured eyes. The flare ebbed from them, and his vision returned. The screen showed only sky and stars. The ship was gone.

"Boom!" said Noel Crispin behind him. "Just like the Fourth of July." Her voice grew harsh, mocking. "Are you quite satisfied, Major Tallentyre?"

He turned around and got to his feet. For months he and the girl had been "Nollie" and "Talley" to each other. But that had changed now. Her set face matched the fierce formality of her greeting.

"Do you feel that you've served your gods, whatever they are?" she demanded. "Will that last burnt offering be sweet in their nostrils?"

Tallentyre gazed at her, dumfounded. "What's all this?" he asked.

She laughed, bitterly and humorlessly. "I suppose that you couldn't help knocking Major DeWitt down—in fact, it brought him to his senses and showed him that he must clear out. As for shooting that captain, I saw through the open door all that led up to it. He had threatened you, and shooting's a clean death, anyway. He can sleep in a grave, back home on Earth. But those other three fellows!"

She lashed Tallentyre with her contemptuous gaze. He cleared his throat uncomfortably. On a desk at hand lay a pack of well-thumbed playing cards. He scowled at them as though they were a new and perplexing mechanism. Automatically he went to the desk, seated himself at it, and picked up the cards.

Still automatically, he began to lay them out for a game of patience.

"Is all this death necessary?" asked Noel Crispin, her voice trembling as if with passionate hatred of him. "Isn't Earth big enough for humanity? Isn't it?"

Tallentyre shook his head without looking up from the cards. "No," he replied, "it isn't. Earth never was big enough for humanity, not since the first of our ancestors lifted his eyes to heaven. You understood that once, Nellie."

"Don't call me pet names, if you please, Major Tallentyre."

"If you didn't understand," he went on, "why did you volunteer for this service?"

"Because I loved you, that's why."

TALLENTYRE seemed ready to fall backward, chair and all. His lips moved soundlessly, his face grew pale. "But I—I never dreamed—"

"Wait a moment. Please don't misunderstand me. I don't love you any more, and that's why I can talk about it as if it had happened to somebody else. But once—oh, I worshipped you as a hero. I thought you were brilliant, brave. I thought you were handsome, in that neat, tight uniform. I signed up so as to be near you. But now!"

Tallentyre stared at the cards in his hand. "I may as well remind you," he said, "that every man in every ship is a volunteer. Nobody is obliged to go."

"You got the answer to that from the captain in the vestibule, just before you shot him. Men don't realize what they're in for when they offer to make the trip. How many do you think would volunteer a second time?" Again she laughed. "If there ever is a second time for any of them, if a single man survives!" She leveled a finger at him, as though it were the muzzle of a gun. "If you're so full of fervor for this murderous business, why don't you volunteer to go

to Mars yourself?"

"I've done so, half a dozen times." The statement surprised Noel, and she let him continue. "The Board says that I'm needed here, in an administrative position. But when I leave here, it won't be for home." He glanced at the window, whence Mars was discernible. "My home will be out there."

She shot him one final glare of almost white heat, whirled around and fled from the room. Tallentyre resumed his game of patience. After a few moments, a slight, stooped figure came through the door. It was Ernie, a white-haired old mechanic.

"Something wrong with the radio?" he inquired gently. "Seems that way. Let me have a look. I thought I heard it blow out."

"It was tuned in on a ship that exploded," Tallentyre informed him.

The slender old man shook his head sadly. "Too bad. Too bad." He poked into the radio mechanism. "Oh, this isn't serious. I'll have everything fixed in a jiffy."

"Everything?" echoed Tallentyre.

Spacehand O'Hara, who should have been watching the jet-gauges of No. 42, scribbled final words on the scrap of grubby paper he held on his knee. Then he surveyed his creation:

*Lost beyond power to follow or seek,
Slain for their gallant defi—
Their spirits were strong but their pin-
ions were weak,
The birds that were lost in the sky.*

*Why should the eyes of a man turn aloft?
The voices of warning chant loudly and
oft,
The fireside is cozy, the armchair is soft,
Yet danger spells dare to the bold.
To search after doom as a knight for the
Grail,*

*With death as a crew-mate, abhorrent
and pale,
To perish as small, glowing sparks on
the trail—
Wee stars in the black, empty cold—*

*Out of dead darkness and into clear
light,
Marking a pathway on high,
See how they soar on a happier flight,
The birds that were lost in the sky.*

*O'Hara put his pencil to the second
line and substituted "steadfast" for "gal-
lant".*

*"It tells something," he assured him-
self. "Perhaps some editor would—"
His eyes came by chance to the jet-
gauge. He had barely time to cry out
at what he saw, before the explosion tore
him and his poem and all the ship into
small, glowing sparks on the trail.*

III.

SOMETHING like twenty hours after DeWitt's resignation by radio, a short-shot rocket came from Earth, made a fairly good landing at Luna Port, and bore away the somber DeWitt, as well as the corpse of the captain. Twenty hours and a few minutes passed before a second craft dropped down on the field, aided by fall-breaking jets of gas directed against its bottom. From it emerged two sturdy men in drab, who came at once to the office.

"Major Tallentyre?" said the oldest of the pair, a tallish man whose harsh eyes were not happy with what he was about to do. "I'm Inspector Baynes and this is Constable Dunlap. We've got a warrant for you."

"Warrant?" Tallentyre rose from his chair. "What kind of a warrant?"

The harsh-eyed Baynes had opened his tunic and was drawing out a paper. "We're from the World League Police. The warrant's charging you with the murder of"—he broke off to read—"of

Captain Sturgis Kiser, whom you killed on the——"

"But I had to," protested Tallentyre. "He was mutinous and threatening. I acted according to my duty, and in self-defense." He turned toward the door of the record room. "Miss Crispin!"

Noel appeared. Her level eyes regarded the two officers as though she had been expecting them.

"You saw the shooting," said Tallentyre. "Tell these men what happened."

She still kept her eyes upon Baynes and Dunlap, and she spoke quietly, without expression, "Major Tallentyre shot and killed him."

"He's admitted that," said Baynes. "What were the circumstances?"

Noel Crispin shook her blond head.

"Nollie!" cried Tallentyre. "You aren't telling the whole truth. You saw him defy and threaten me." He broke off, for at last she looked at him, in hard and merciless triumph.

Constable Dunlap took a step forward, as though to lay hands on Tallentyre. But the port commander faced him so fiercely as to freeze him to the metal floor.

"Hold on," snapped Tallentyre. "You haven't authority, here on the Moon. I'll resist arrest."

"Right, Major!" piped a clear old voice from the direction of the hall. White-haired Ernie, pausing on some errand, had stepped into the office. Both policemen stared truculently at him.

"Who's this?" grumbled Inspector Baynes to Noel.

"He's Ernie. Rocket mechanic, second class. What's your last name, Ernie?"

"Moessner," said the old fellow. "Major Tallentyre, stand your ground. You can't let them take you—not when you're needed here so badly."

Noel was looking at Ernie with widened eyes. "You're—you say your name's Moessner?"

"That's right."

Tallentyre and the officers were also watching the aged mechanic. "Hm-m-m," said Baynes, "that's the name of the guy who invented *moessnerol*."

"He was my father."

The silence that fell was as effective as though it had come at the high point of a stage drama. Ernie Moessner, who had brought about that silence, broke it again.

"I'm the last Moessner, folks. I'm getting old—so old that I was supposed to retire—but I hope I can die with my boots on, like the rest of my family."

His old eyes met Noel's, and they glowed as palely as the heart of a rocket-blast. He laughed shortly.

"You're breaking down under the bloodshed, aren't you, lady? How'd you feel if these men who kept dying were your own flesh and blood? Answer me that."

Her lips trembled open. "I never knew——"

"But I did!" cried the mechanic, tossing back the white locks from his burning eyes. "I know how they died, and why. Listen!"

EVERYONE was listening.

"I'm seventy-six years old. My first memory was when my dad held me up on his shoulder, so that I could see a parade. The air was all snowy with paper confetti, and sitting on the folded-back top of the Mayor's car was a tall young fellow without a hat. That was Charles Lindbergh, in 1927, and my dad said, 'This is only the beginning, son.'

"You all know how he studied atomic hydrogen for a fuel, and how he was killed by it when he perfected it. His kid brother, my uncle, died flying the first rocket to the Moon. I was in the second, the successful flight—though why I was spared when better men were taken, I don't know."

Baynes and Dunlap were gazing, rapt

and abashed. Noel again attempted to speak. "But Ernie, others are dying and——"

"I'm coming to that. Remember when Major Tallentyre here killed this mutinous captain, and made over the command to a chap named Joe? Like me, he got along without folks worrying about his last name. Well, it was the same as mine. Moessner."

"Your son!" cried Noel.

"My son. My only son. He almost backed out, I guess. But he went, and I'm glad he went. The old prophet was wrong—a living dog isn't better than a dead lion. I'm glad, too, that I sneaked out of retirement to do plain greasy labor here. And one thing more; everything else can crack, but the rockets will keep going to Mars if Major Tallentyre and I are the only ones to shove them along!"

Noel spun around. "Talley," she began, "I want to say something that I didn't think I——"

But Tallentyre was gone.

In the midst of the old man's speech he had backed out into the vestibule and turned down the hallway to an airlock. There hung space-armor, into which he fairly plunged, making its metal-mounted fabric airtight with a single tug of the seal-zipper. On went metal-shod sandals, the heavy girdle that supported oxygen tank and breathing apparatus, and the helmet, a transparent globe clouded against the pitiless sun-rays of space.

Up the hall rose a clamor of voices, a fall of excited feet. Tallentyre was in the airlock, through it, clanging across the metal face of the landing field. He meant to flee, but only for a while. Perhaps the officers would follow. Then he could slip back into the unguarded port building, organize his defense. He would make the Rocket Service Board listen to him over the radio, exonerate him. Meanwhile, which way lay sanctuary?

DEEPER and deeper into the blackness walked Tallentyre, half groping, half trusting to his memories of many journeys along the trail to the crag.

Funny to feel so heavy on the Moon, where gravity is only one-sixth that of Earth. Surely it wasn't because of Noel—he, Tallentyre, had never thought of her as a lover until she had admitted her own secret. Now she had turned into an enemy, one who would keep silent when a single truthful word would clear him of the murder charge. Better put her out of mind.

Lights danced in the gloom behind him—those who hunted him. He made some degree of speed, gained the foot of the rock. Three thousand feet upward it soared, but he, even in armor, would weigh less than forty pounds against Moon's feathery pull. Up the hewn trail he scrambled, scarcely pausing for breath until he gained the top-most shelf. There he felt safe in turning on his head-lamp. Far below he saw the landing field, its lights undiluted and unrefracted. It was a gold coin on tarry blackness. He turned away and entered the observatory building.

His glow-lamp revealed the inside of the dome—a metal-lined compartment, pierced above with a starry slit into which sloped the tube of the telescope like a gun at an embrasure. At its lower end the sensitized screen—even on the Moon, this new device had replaced the old reflection mirror—displayed a segment of the heavens. A blob of light showed in the center. Mars, of course. Tallentyre switched off his lamp again, in order to see more clearly.

The image was not of Mars. That egg-shape could be but one thing: a spaceship. To judge by the direction of the rocket-blasts, it was heading Moonward. The same craft, Tallentyre made no doubt, that he had observed earlier as doubled about and returning along its track. Now it was very close indeed. He judged that it would make

port within an hour—within minutes, perhaps—

A new glow was creeping into the observatory.

Spinning on his metal-shod heel, Tallentyre stared. A human silhouette paused on the threshold, a figure made bulky and mysterious by space-overall and helmet.

This meant capture. The newcomer bore a gun in a holster at one side, and he, Tallentyre, was unarmed. But the gauntleted right hand did not reach for the weapon. Instead it beckoned to Tallentyre, then pointed outward and downward.

"Go back to the port," said the gesture.

Tallentyre lifted his own arms in token of surrender, but his heart was far from concurring. He walked across the floor, made to push past the other and step outside. Then he spun and sprang. His two hands clutched like lightning. His right caught and imprisoned his discoverer's right wrist. His left found and captured the automatic pistol. A moment later he pressed the muzzle into the midst of the stranger's inflated jumper. Tallentyre's helmet-front grated against the glass that covered the other's face. He could see dimly—features that he recognized.

Noel Crispin.

Plainly she expected him to shoot. He grinned scornfully, and tossed the gun away. It sailed out into darkness, over the hidden ledge and into the abyss. Tallentyre gave her a little shove across the doorsill. She moved away, stooping dejectedly in her clumsy armor, and her glowing lamp showed her the direction of the down trail. Another moment, and she was lowering herself out of sight.

Alone again, Tallentyre gazed into the stars. That bright new gleam would be the incoming ship. It meant to land here. Then what? He, the port com-

mander, could play hide-and-seek no longer. He must be on hand to receive those mutineers, to pass judgment upon them. He sighed as though in exhaustion, and said "Damn!" all to himself, in the little bubble of air that was confined about him in this immensity of void.

Minutes later he turned on his own lamp and began the descent.

As he scrambled, alone in the empty dark, he thought glumly about Noel, then about women in general. Woman-kind must be considered in this whole great Martian adventure. It couldn't be all a stag party. Sooner or later, the feminine angle would have to be introduced, made room for. What then? Would women help or hinder, simplify or complicate? Would women even trust themselves in those danger-ridden rocketships?

Engineer Dague of Number Forty-five stared blankly at the stowaway whom the spacehands had just dragged from hiding. "You, Ethel!"

"Me," she replied ungrammatically, and smiled her sauciest. "I told you that I'd follow you. It's Mars or bust, right beside you, darling."

"You know that it's more than an even chance of bust."

"Then we'll bust together!"

As if in acceptance of that proposition, the ship exploded around them like a shell. Poppy fire bloomed briefly in requiem.

IV

NOBODY CHALLENGED the port commander as he strode across the landing field and let himself through the lock-panel. He paused in the hall to unship his helmet. At once he heard a hubbub of voices. Noel Crispin's troubled soprano dominated them for an instant.

"I found him, by a hunch—he was up at the observatory. I tried to signal

to him that everything was all right, and to come back, but for a moment I thought he'd kill me. Then he almost pushed me down the rock."

"He thought you were hunting him," rejoined the growl of Inspector Baynes. "I say once more, you ought to have spoken up and cleared him when he asked you to."

"Never mind scolding her, inspector," chimed in Ernie Moessner, as authoritatively as though he were the chairman of the World League instead of a simple mechanic. "She's a woman, and women have a way of changing their minds. The thing is to find Major Tallentyre before something happens to him."

"I'm here," called the man they were seeking, and walked into the office. The four searchers crowded around him, but he silenced their questions with a quick gesture.

"A ship's coming into port," he announced crisply. "From Mars. Prepare to help it to land."

They all gasped at that, and their surprised exclamations overlapped each other.

"A ship . . . From Mars . . . Coming back!" Tallentyre's pose of official sternness forsook him.

"The fools," he groaned. "Oh, the utter fools! To turn around in space and come back here—mutiny! I'll have to put them under arrest, send them to Earth, maybe kill some of them if they resist. And all the time maybe they're only showing good sense in not fighting Nature."

Noel's strong little fingers dug into his shoulder, as though she was holding together his crumbling resolve. His own big hand went up to close upon hers. Then, once more the commander, he spoke into the house microphone.

"Attention, machine shop!" he rasped. "Stand by to help approaching craft into port." To Dunlap and Baynes he said, "There's something for you to do. Ar-

rest the crew as soon as it disembarks."

The two policemen nodded. They were good men of their trade, hardened to arresting and subduing law-breakers. Zipping tight their loosened space-overalls and once more donning their helmets, they tramped out. Moessner followed.

Tallentyre and Noel gazed through the window. The craft was settling down outside. Tallentyre could not make out its number, for it seemed to be mended and patched all over in a way he did not remember, as he checked over the ships in his mind. From many tiny nozzles in the metal face of the landing field came the strong gush of steamy vapor. High-pressure gas jets, to break the descent of the ship. It paused, danced overhead like a ball on a fountain-spray, then came gently to rest. A moment later the lock-panel opened and two space-overalled figures emerged. The officers were hurrying toward them, hands on weapons. The four men came together, formed a single party, and passed slantwise across the field, out of range of the window.

Tallentyre sighed. Noel patted his shoulder. After a moment, metal shoes rang flatly in the vestibule. The door opened. Four men came in, tugging at their helmets.

A pudgy man disclosed his face first. He was ruddy and bearded, his sun-mottled face grinning. "Major Tallentyre, sir," he boomed, "I don't know whether you remember me or not. I'm Waddell, spacehand, first-class. Acting skipper of—"

"You're neither," interrupted Tallentyre. "I put you under arrest, Waddell. Why didn't you go on to Mars?"

Waddell looked blank. Then the grin reappeared and widened. "Because I'd been there once, sir."

TALLENTYRE felt himself stumble. Noel's hands helped him to a chair and to sit down. He listened, compre-

hending by degrees.

"Yes, sir. Number Six, that ship was. There's a colony there now, getting ready to gather up the last bunch that came through. You remember the orders—orbital speed, and land on Diemos. Photograph maps of Mars made from there. It worked perfectly. With the telephoto lenses we had regular air-maps of the planet.

"There aren't any canals, sir. But there is vegetation, lots of it. Spiny growths like cacti, and tougher'n rubber. But the pith of some of 'em makes a flour we can eat.

"Most important, they throw off oxygen. There's damn little air on Mars, but what there is is mostly oxygen. No trick at all to blow it into the ships—into the dome we set up from hull plates. And—there's oil there, Major! Fuel!"

"Now with that there," Waddell's face split in a broad grin, "and a gang of men that were all hard-boiled technicians, it wasn't much of a trick to set up some of the auxiliary-power Diesels for power."

He stopped for a while, and looked at Tallentyre's seamed face. "Been a damned tough life you've had here, hasn't it? Sending men out in those firecrackers.

"Well, that's gone too." His hand dipped into his tunic pocket to come out with a nodule of blue-silvery metal. He tossed it to Tallentyre. "That's the answer. That's why our ships went through—and the others blew their tubes. We had something to work on that you birds didn't. Tubes that had been *proven*. The metal changes in the tubes, under the long, heavy firing. The alloy shifts. If it crystallizes that way—you land. There's another modification though. If it crystallizes that other way—you blow. That other way is catalytic on the hydrogen, that's the trouble. The fuel's all right. It's the metal. If those cockeyed crystals form—they catalyze the burning. It doesn't burn then,

it blows. You get a flash-back, a sort of special explosion wave that sets off the whole tank.

"We found out how to make those crystals every time, controlled. Old Six's tubes were torn out, and the new ones put in. She rode back to Luna here as smooth as an engineer's theory. Somebody had to come through. We need more men out there. Grayson's trying to set a station on Diemos. His figures look right, and he thinks he can make Callisto."

"Callisto!" Noel's hand left Tallentyre's shoulder, crept around him. Her arm hugged his body. Still sitting, he leaned against her as though to find rest.

THIS, he knew in his heart, was the beginning of the triumph. Men could go—men had gone—to Mars and back. The labors and the sorrows had not been vain. Hadn't Waddell brought back the secret—the secret men on Earth couldn't learn—that made fleets possible? Wasn't Grayson, there on Mars, already looking on, beyond the asteroids to Jupiter—?

The officers had taken off their helmets again. Tallentyre turned and smiled at them. "Sorry, gentlemen," he said. "It's a dry haul for you this time. Why don't you go back to Earth—take Waddell here with you to make his report to the Board—and—"

"Hey," Waddell interrupted, "noth-

ing doing. That ship out there is O. K. right now for the trip back home—Mars, I mean. Gimme some *moessnerol* and we'll hop that hole like a frog-puddle. I'm going back there.

"And I wouldn't ride in one of those ships just out from Earth now. That's the only ship in the System I'd trust to ride anyway. Give him the metal samples, and the books and notes Grayson and Hudson fixed up. They said it's all there. I'm no metallurgist—just a space-hand, first-class."

Tallentyre shook his head. A tight little grin tucked in the corners of his mouth. "I'm ordering you to Earth, Waddell. You make that report in person for three reasons; they need to see a man that's been to Mars and back. It will give them courage again. We'll fix the tubes on the ship that takes you back. And—you'll be taking my resignation."

"But the ship!" Waddell protested. "If it doesn't go today, sir, Mars'll get away from us for nearly two years!"

Tallentyre rose from his chair. He looked smug. "Oh, the ship will start today. But I'll command. *I'm* going to Mars for a change. And perhaps—"

He broke off and looked at Noel. Her face became radiant. She whirled about as tears brimmed her eyes, but her words were a song.

"I'll start packing," she said. "This can't be a stag party forever!"

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FANTASTIC FICTION

The other fellow's field has a tendency to look greener, of course, and that obscures things for us a bit, I think. The predictions made in stories, for instance. They talk about those greener, future fields. And the curious thing is that they go on predicting things—after they're all present and accounted for.

We haven't built spaceships yet. We haven't atomic power. But many of the details that were predicted—and continue to be "predicted" in stories—have arrived, so quietly and naturally we fail to notice.

In the stories of the era of 1930, no future civilization really counted unless it had a flexible glass that a sledge-hammer wouldn't break. Modern technicians make it and call it "Plexiglass" or "Lucite" or methyl methacrylate nowadays.

And the people wore clothes that were proof against heat and cold, would not stain or fade under sunlight. Spun glass fabrics is the manufacturer's simpler description today.

Metals, the stories predicted, would be dyed, not painted. Quite right. But it isn't a prediction now, it's a fact. And steel so hard it would cut glass, yet so malleable it could be bent double. It was to be a wonderful alloy of a dozen strange elements. Wrong, that time. They do it with ordinary carbon steel, by a process called "austempering." Steel that's file-hard and readily scratches glass and yet can be bent double on itself without fracturing. (Try to bend an ordinary file!)

They were to have an anesthetic, by about the year 2000, that would permit a man to watch his own operation. They do it now with novacaine injected directly into the spinal fluid.

And gold from sea-water? No—but gold isn't a particularly useful substance. Bromine is a lot more practical, and they do get that. Magnesium, too, for that matter. It's recovered directly as magnesium hydroxide, and sold as such in the form of milk of magnesia. (The United States consumes 15,000 gallons a day—largely medicinally!) There's a thriving town in Michigan that lives by reason of salt water they pump from wells.

Fact differs from fiction in this; science-fiction presents all those things suddenly, fact requires a generation of improvement and change to attain the practical, useful article. And by that time, we have become accustomed to the idea, accept it so readily and naturally as to see no particular advance.

Spaceships and atomic power to come. I think they'll come pretty much together—and both pretty quickly. Not because the spaceship *must* wait for atomic power, but because it *has* waited. No one man is going to discover the secret of atomic power. A century from now men will almost certainly say that one of the present great in the field was the discoverer of the secret of atomic power. We say today that Faraday discovered the principle of the electric dynamo and motor, though he never would recognize the modern turboalternator.

But you can be fairly certain of this: *the discoverer of the secret of atomic power is alive on Earth today.* His papers and researches are appearing regularly; his name is known. But the exact handling of the principles he's discovered—not even he knows now.

We don't know which is his name. But we know him. *He's here today.*

The Editor.

BELOW— ABSOLUTE!

by
Harry Walton

*Space was cold—but the Pit was infinitely
colder—colder than Zero Absolute!*

OF course I've suspected it a long time," muttered Hampden from among the instruments in the navigation cubby, "but it gives you a turn to find out beyond the shadow of a doubt that the chap you've picked out for a space buddy is star-struck, loony as——"

"I know—I know," murmured his partner, Kerry Holm, six feet of indolent Earthman, at present engaged in nothing more vital than a game of solitaire chess. "But am I complaining? You mayn't believe this, Red, but it scarcely shows on you——"

"Space batty, I say," Hampden continued firmly. "No sane Internickel man would head out this far beyond Pluto's orbit. Our chances of finding payrock out here are nil. And our chances of getting a black meteor through us are inversely swell. And maybe you can afford to loaf through the galaxy sight-seeing, but I can't. Especially since we passed up that juicy mercury find a while ago——"

Kerry Holm yawned, reached into a locker and drew forth a small notebook. He turned the metal foil pages as though each were a volume in itself.

"You know, we couldn't report that to International Nickel and Mining Co.

They'd have bunged out there with a fleet of ore ships and mopped it up. The damn stuff was alive. Forget it and listen to this: Proxima Centauri disappeared thirteen months ago. Alpha Centauri—which, if you remember your high school Galaxy, is a double star—has cooled to invisibility."

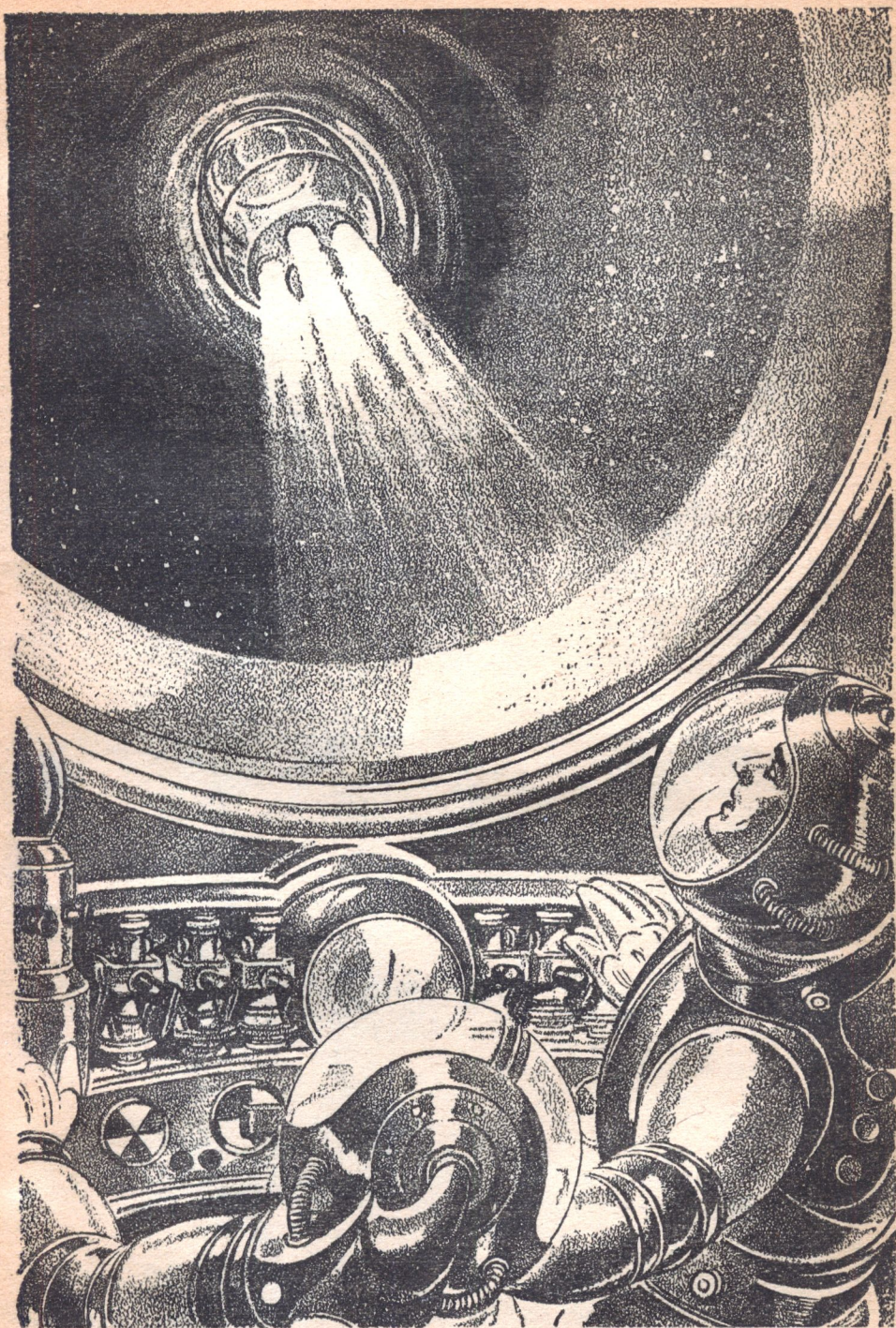
"Intriguing if true, but none of our business," growled Hampden, slamming the cubby door behind him. "So what?"

"So certain scientists are a bit uneasy. Because stars don't blink out within the space of a few months, as a rule. All of which is leading up to a little surprise I have for you. Can you take it?"

For answer Hampden shot Holm a scornful glance, and proceeded to set up the magnetic chessmen for a new game.

"You see," continued Holm, "having the new inter-galactic gear for the real high-speed work, it seemed a shame not to use it. So I headed for Alphy—in fact, we're half way there. If you knew navigation, you'd have caught on. Where are you going?"

"To twist our tail about and head for Earth," responded Hampden bitterly, "before you begin biting your own ears. Maybe I can swap you for a student spacey if I beg hard enough."



*The tiny lifeboat bored on into the unutterable cold of the Pit.
But—would its slight mass help—?*

He yanked open the navigation door. Holm reached out and neatly tripped him. With the agility of the space-trained, Hampden landed on both hands and was up again in an instant.

"Sit down," Holm ordered wearily. "And listen. About two years ago Stevensall discovered a dark spot *between* us and Alpha Centauri. Of course there have been other dark spots observed—utterly black areas of sky, dark nebulae such as the 'Coal Sack' in the Milky Way. They're usually believed to be masses of matter which obscure the light of the stars behind them."

"And so we're going to investigate it," burst out Hampden, "and see whether it had anything to do with the decease of two distant stars. Neither of which matter a molecule to you, me, or the Solar System in general. Craters of Titan!"

"Correct but for one thing. These weren't distant stars. They were our nearest neighbors—a mere skip of a little over four light-years away—and it seemed neighborly, having the new gear aboard, to pop over and see what's wrong. At least, that's what Stevensall and I thought. You know we were chummy at college."

"Neighborly!" exploded Hampden. "You pour on two weeks' fuel running away from perfectly good payrock, and keep mum all along as though you had a new thorium find up your sleeve, just to satisfy your cursed curiosity. That," he finished bitterly, "is a pal!"

Holm shrugged, grinned knowingly, and curved his spine a little deeper into the comfortable hollow of his chair. Hampden sullenly began his game, but the redhead's anger was already subsiding, as his partner had known it would.

UPON THE perfect silence of their flight impinged the sudden, strident jangle of a warning bell. Holm was instantly on his feet, responsive as a steel spring, lethargy gone.

"Shouldn't be anything near us big enough to sound that signal," he snapped. "Something's up."

They hastened together past the quivering needles of gravity indicators and magnetic detectors to the visiport in the nose of the ship. Holm snapped the port shutters aside. Keenly aware that they might face the certainty of disaster there, both stared tensely outward. Power having been shut off and retarding blasts applied by her detector mechanism, the ship was decelerating stiffly. For all that, they were prepared to leap to the controls for full reversal the instant they knew what menaced—and were the less prepared for the fact.

For space before them was empty, with an emptiness not of space. A black meteor, or a swarm of particles, they were ready to face, but sight recoiled from the sheer vacuum of non-spatial darkness which gaped ahead of the ship. This was nothingness made tangible, a canyon of blackness in which the stars were lost, incredibly empty and hostile in its very negation of all things normal.

And in the ship behind, the bell clamored furiously. Needles trembled in mute but frantic warning. The course indicator dipped sharply off-course.

"We've arced ninety degrees," shouted Holm above the din. "Left drive correction ninety, sixty megadynes."

Hampden leaped to the controls and performed the maneuver. The *Bonanza II* came quivering to a halt, straining at the power leash that tethered her. The high-speed field controls locked thus, both men repaired again to the visiport, to stare for minutes, wordlessly.

This was no dark body blotting out the stellar field beyond, no long-dead sun hurtling its cold way unseen through the burial place of the stars, no obscuring cloud of cosmic dust. Of that they presently felt certain. Its outline against the tapestry of the stars was that of an enormous, perfectly circular disk,

and—although neither man would have admitted it—both felt it possessed of motion within itself. It crossed Holm's thought that this was an all-absorbing funnel draining into unknown space and time, a sucking vacuum of nothingness alien to space as they knew it.

"It rings the meteor-warning, yanks the ship off-course, sets every gravity indicator wagging, and isn't there when we look," murmured Hampden softly. "I take it back, Kerry. *I'm batty.*"

"No more than usual. There's something queer out there——"

"It's enough," said Hampden, staring fixedly from the port, "to give you creeps and shivers."

His tone caused Holm to look at him sharply. Hampden *was* shivering, his body unconsciously tense, his breath white. A thin crystal glaze of condensed and frozen vapor overlay the instrument glasses.

"Heat trap!" roared Holm.

He clasped stiff fingers around controls already so cold that flesh froze fast to them by its own moisture, his knuckles white as he wrenched the accelerator over. The *Bonanza II* stood on her tail, motors blasting, and tore away as though space devils were after her.

ONLY AFTER a period of flight that left the dark spot a mere disk off her quarter did Holm bring the ship to rest. Automatic thermostats and heaters had meanwhile brought the temperature back to normal, but the icy finger of death remained a vivid memory.

"I thought heat traps were a thing of the past," muttered Hampden.

"Supposed to be." Holm shrugged. "Before ships were properly insulated, heat traps were just one of the chances you took. You'd enter the atmosphere of a strange planet, concentrating on your landing and unaware that the atmosphere—of ammonia or methane perhaps—was a lot colder than liquid air.

Before you knew it, heat was 'draining out of your ship and you crashed as the result of frozen controls or frozen fingers—or both."

"But we've been in such atmospheres, in this very ship——"

"Check. And no bad results, thanks to modern hull insulation. The ship is built to keep its heat indefinitely, even in an atmosphere that's pretty close to absolute zero. That's why it's funny that we dropped into a heat trap—in empty space."

"Maybe," suggested Hampden hopefully, "our insulation is gone."

"Wrong. This ship is insulated," explained Holm as though lecturing a class of spaceys, "to guard against heat loss in cold atmosphere and against roasting the occupants when near radiating bodies—suns to you. But so far as empty space is concerned, we don't need any insulation; we shouldn't lose a degree a week out here. To explain: you know that the transfer of heat is always from the hotter body to a colder one. Empty space being at absolute zero—or nearly so—you might expect heat to leak from the ship into space. But space, although colder, is not a colder *body*. Space is empty of heat because it's empty of matter, and for the same reason it can't absorb heat from the ship. There are no molecules of matter in empty space to absorb the motion of heat-energy of a solid. But a cold atmosphere, being a gas composed of material molecules, will absorb heat if in contact with a body hotter than itself. Hence the need for insulation."

"Maybe the Pit—the dark spot—consists of gas," offered Hampden.

"Even then, our insulation should have taken care of us. It's rated safe to 270°. No, whatever we hit there was a lot colder than that—colder than absolute zero."

"Nothing can be colder than absolute zero," stated Hampden dogmatically. "But I'd feel better if we were away

from these parts and heading back to the Solar System."

"If that's how you feel, O. K. It's hard on Stevensall, of course. He's said a lot about that business out there that hasn't helped his reputation, and I hoped to help him out by taking observations while we're here. But if that's how you feel——"

"That's how I feel," groaned Hampden. "But being what I am, I'll let you take us back into that trap so that you can tell a few bearded nitwits back on Earth how it feels to freeze in the cause of science. Go ahead."

HOLM, grinning, stood to the controls. A moment later the *Bonanza II* was rocketing back toward the menace of the Pit. Both men struggled into space-suits which were fitted with individual heating units. The ship's emergency heating equipment was also cut in at maximum.

"Can't expect these suits to do us much good," grumbled Hampden, speaking through the helmet phones, "if our heat leaked out right through the ship's insulation. Somebody's going to chop us out of the solid block, a century or so from now."

Again thermometer needles dipped low and gravity indicators swung to the mysterious attraction of the dark spot. Despite the tremendous heat output of their generators, both men felt a cold that penetrated rubber, steel and fabric alike, and their teeth chattered behind their helmet lenses.

"—have to turn back. Danger ahead," Holm heard himself say. His helmet-phone spoke at the same instant.

"What did you say?" he asked Hampden.

"Same thing you did."

"Butting in on my wave length. Well, if I said what I think I did, I'm going melodramatic with age."

Hampden grunted.

"You must stop or be destroyed,"

spoke Holm's headset. He was looking at Hampden, and saw his partner's lips frame the words.

"So it's you that's going melodramatic," he chuckled. "I take back my apology."

"What do you mean, me?" queried Hampden indignantly. "You said that!"

"I did not."

"Well, I most certainly didn't," retorted Hampden. "I *saw* you."

"It will be extremely dangerous for you to enter the passage," remarked Holm gravely, adding at once: "I didn't say that! At least, I didn't think it. For Pluto's sake, Red, what's wrong with us?"

Hampden eyed him suspiciously.

"If I hadn't been watching you I might think you've been inhaling some of that alcoholic panther sweat we carry for snakebite. You are nearing—the limits of your space. Stop while you can."

So obviously were the last statements not Hampden's own, that Holm reached almost automatically for the braking controls, a slow whistle forming on his lips. Abruptly he applied retarding blasts, jockeying the *Bonanza II* to a halt in midspace before the fathomless dark zone.

"I didn't want to say that," chattered Hampden. "I—just did, somehow."

"You and who else? And while we're on the subject, if we're near the limits of our space, what space is beyond?" asked Holm, and proceeded to answer his own question: "It can best be designated as other-space. No comparison is possible on a physical basis, since matter, the measuring rod of the space which it bends around itself, is always peculiar to that space and not transferable to an alien continuum. Were you to enter our space, you and your ship would be annihilated."

"It's cold," said Hampden tartly.

"Talk sense and get us out of here. You can figure out why this cosmic north

pole later on— Tending to uniform distribution, energy flows from the higher level to the lower. Our universe is, throughout, at a far lower level of energy than yours. Your ship, like all your matter, is to us a radiant body—a miniature sun—whose heat is transmitted to us through the space-rupture which you see as a dark area of the heavens. To us this connecting passage is ablaze with light and heat. You appear to us to be living in a veritable furnace. We, could you see us at all, would seem to dwell in eternal cold and darkness.”

HAMPDEN'S astonishment, as he stopped speaking, was comical.

“That,” chuckled Holm, “answers your question, even if you didn't ask it. And it means we'd better get away while we have some of our heat left, before our fuel gives out—you will be wise to withdraw, and will still be able to communicate with us, as thought is a form of energy unaffected by space or matter.”

Hampden eyed him wryly. “Part of that makes sense,” he muttered, much mystified. “About getting away, I mean. Let's.”

Holm nodded, took the controls and sent the ship a few thousand miles back, until warmth returned to their chilled bodies and they were able to doff the cumbersome space-suits. He locked the controls to hold the ship motionless in space, then stretched his length in the softest of the cabin chairs, yawning prodigiously in a way that betokened the keenest interest on his part.

“We know by now,” he said, “that something is in communication with us—something living in ‘other-space’. But why does it communicate by making us talk to ourselves?”

“Because your conscious minds are unaccustomed to direct telepathy,” responded Hampden as proxy for the unknown. “Your subconscious minds present no such obstacle, and readily ac-

cept my thought, of which you know nothing until—quite unconsciously—you have translated it into your own words and expressed them in sound—I don't like this!” finished Hampden rebelliously.

“How can your system be at a lower energy level—that is, colder—than matter at absolute zero?” pursued Holm. “Matter at this temperature is said to lack any trace of heat.”

“Of transferable heat,” was the reply, again through Hampden. “But even at absolute zero, matter cannot lose all its heat energy. Each of its atomic oscillations possesses still one-half a quantum of energy, which, however, is inseparable from the atom itself, and therefore not apparent to you as heat. Your atoms are built to an infinitely larger world-scale than ours—their atomic oscillations are of correspondingly enormous energy. Thus, even the minimum one-half quantum of energy which your atoms possess at absolute zero represents in our system an explosion of radiant energy, visible to us as heat and light. When this basic energy of your atoms flows, as it must, to the lower energy level offered by our universe, your matter ceases to exist.”

Holm whistled softly.

“That explains the disappearance of Proxima Centauri. Its atoms cooled to absolute zero, radiated their remaining basic energy, and collapsed. What, then, is to prevent the heat energy, or atomic oscillation of all matter in our system from flowing to yours—the whole transfer to end in the annihilation of all matter as we know it?”

“Nothing!” was the astonishing answer, coming again through Hampden. “We knew that would follow the opening of the Passage. But we were unwilling to allow you to destroy yourself before the doom of your system overtakes you, and therefore warned you

against entering the Passage."

"Just what is the Passage?" asked Holm.

"An artificial rupture of the space-time continuums involved, which we were enabled to bring about by taking advantage of a rare cosmic occurrence—a super-nova, or exploding star, that simultaneously ruptured your space at a point which now marks the opposite end of the Passage."

"Nova Centauri! But that was observed years ago, at a distance of two million light years, whereas the Passage is only two years old. You waited two million years after the explosion!"

"By your time measurements. But time also passes at different rates in your universe and ours. Nevertheless, we had long awaited such an opportunity. The entropy of our universe is at its maximum, our suns burnt out, energy dispersed throughout our space. Only energy from an outside source, such as reaches us through the Passage, can save us."

"Then you're willing to save your universe at the cost of ours!" roared Holm.

"SELF-PRESERVATION demands no less. Emotion, such as you display now, is foreign to us and cannot move us. Your only reasonable attitude must be one of resignation, since in cold logic you cannot ask us to be so foolish as to surrender this life-giving energy of yours. Were we to destroy the Passage now, we might be unable to establish contact again in time to save ourselves—perhaps not before your own sun would have burnt itself out in its normal span of existence. Instead, its energy, transferred through the Passage, will rekindle six of our dead suns and sustain life on our worlds long after you and yours have perished."

"A pretty picture!" grated Holm. "The sun dead within a year or less! Why don't they blast us out of our own universe and be done? It would amount

to the same thing. What shall we do about it?"

"Get help from Earth, I suppose," responded Hampden.

"Rubbish! It would take us six months to convince the Planetary Council, twice that long to get into action. What can we do—now?"

"The two of us? Nothing, of course. A thing you can't see——"

"—may be vulnerable enough, if we only knew where, and how. Has it struck you that its story doesn't jibe?" Holm said thoughtfully. "It claims to be emotionless and thinks nothing of wiping out life in our universe by draining away the energy upon which life subsists. Yet it was anxious to keep us from being destroyed, and warned us to stay out of the Passage—*why?* Was it because our entering that other-space—its own space-time continuum—*would endanger it?*"

"We know that matter and radiation are alike—that radiation is an attenuated state of matter, a dilution so to speak. Through the Passage it can absorb radiation. Free electrons, photons, even protons, are welcome. But I believe that whole normal atoms, representing *concentrations* of energy, are not—and it must be because atoms, with their internal energy intact, are bombshells of energy so far as that universe goes. No doubt we'll go up in a puff if we enter infra-space—our atoms would disintegrate in seeking the low energy level normal to a universe of infra-atoms—but they'd be super-dynamite in doing it.

"It's afraid of that—and, by glory, it's going to be more afraid. We'll drive for the Passage as though to go through. We'll bluff it—or them—into wiping out the Passage. And they'll do it, rather than risk our entering their space. Game?"

"No!" snarled Hampden, to Holm's astonishment. "I'll not risk my neck in your crazy schemes any longer.

You've no proof at all that they're afraid of us—we'd be throwing ourselves away."

"We would not," responded Holm with quiet intensity. "If everything goes wrong—if the bluff fails to work—we can keep on until—until the ship does go. There's just a chance that the atomic explosion would disrupt the Passage. I think it's up to us to gamble on that chance——"

"You think so." Hampden backed away. He cowered beside the discarded space-suits like a cornered, desperate animal. "You'll do nothing of the kind if——"

HIS HAND, fumbling among the accouterments of the suits, swung back suddenly, and flung something. A specimen-hammer hurtled past Holm's temple. As the astonished elder spaceman sprang to his feet, Hampden found a deadlier weapon—a heat gun. Its beam crackled furiously against the metal bulkhead of the ship as Holm ducked behind the temporary shelter afforded by a cabin chair.

"Red! For God's sake, what is wrong with you? Are you hypnotized?"

"Completely," returned Hampden. "We control him from other-space. Without danger to ourselves we shall compel him to destroy you both—after disposing of your ship so that it shall no longer menace us. At first we would have allowed you to return to your doomed system, but you have guessed too much of the truth."

Inexorably, the heat beam arced downward, blistering its path across the bulkhead. The metal panel-back of the chair glowed hotly before Holm's face. He knew it would be a matter of seconds only before it melted through.

The cabin chairs were fastened with jiffy catches, holding them firmly to the floor, yet permitting their removal and re-attachment as might be convenient. A quick twist of a single lever loosened

the four catches, although the hot metal seared his palm painfully. Carefully, but with madly beating heart, Holm gauged the distance to the navigation cubby door, the vital inches which spelled success or failure, life or death—immediately for himself, eventually, perhaps, for his world.

It was desperately far. Hampden, alert and in control of his own faculties, could balk the attempt Holm was considering with deadly effect. But Hampden's reactions, controlled by an intelligence which saw and heard through the Earthman's mesmerized senses, might well be slower and imperfect. On this Holm fastened his slim hope of survival.

With a lurch he threw himself sideways, grasping the chair firmly and dragging it along as a shield, stifling the cry of pain which his burnt hands wrung from him. In that first desperate effort he got half way to his goal before the heat pencil swooped after him. He staggered to his feet, hurled the chair full force at Hampden, and reeled through the door into the navigation cubby. The heat beam blazed against the door even as he swung it shut and locked it.

He had gained control of the *Bonanza II*. The bulkhead and door were impervious to mere heat beams, and Hampden could not interfere from without the cubby. But he himself, Holm knew, was not immune to the hypnosis of the intelligence beyond the Passage. It would shift the attack to him, and although he might resist for a time, there could be only one end to such a mental duel in which he was a mere novice.

He roused himself from these musings with a start. So subtle had the suggestion been, so cleverly foisted upon him in the guise of his own thought rather than as that of an intruding and alien will, that he found himself almost incredulous before the fact. Nevertheless, the mental bombardment had begun, and was perhaps only the first symptom of complete hypnotic domination such as

had possessed Hampden. Holm wondered whether he could long remain the victor, in possession of his own will—and then wondered whether even this passing thought was not implanted by a mind other than his.

At least it was obvious that “they”—capable of reading mind and thought alike—could not be bluffed into dissolving the Passage as Holm had first supposed. Desperate action alone might succeed, and he saw with cruel clarity that his time for action was limited. Not only from within his own thought, but from without, through his own tongue, the pressure of suggestion was being brought to bear. Despite himself he spoke, voicing the will of the unknown, telling himself that there was no cause for fear, that he should open the door and take counsel with Hampden, that they would be permitted to depart unharmed. And, again, he knew these were lies, and that Hampden would burn him down mercilessly on sight. From amid the chaos of contradictory thoughts, he caught an urgency which drove him on, although insistent speech—curiously at variance with his state of mind—fell unhurriedly from his lips as he made frantic preparations for what he must do.

REALITY VANISHED. He seemed, in his operations of the controls, to be stumbling through a dream. Fatigue and an irrefutable sense of the unreality of his struggle besieged him. Had the working of the controls not been mechanical, burned into his brain by repetition, he could never have finished.

He got the ship under way and driving with full blasts for the Passage, its automatic pilot set to follow the gravitational pull of the infra-universe beyond. Unless the manual controls were again cut in, the *Bonanza II* would hold her course into the dark funnel that led into alien space. Already it was cold in the navigation cubby. The ship was speedily

losing heat—despite insulation and thermal equipment—to heat-greedy infra-space.

Holm was no longer sure that he was alone. It seemed, sometimes, that Hampden was in the cubby with him. Again, there were voices that could have been only his own, pleading, commanding, cajoling, threatening. In increasingly brief moments of lucid thought he knew that he was succumbing, but for the most part he was dazed, uncertain of himself, forgetful of the desperate purpose that had brought him here.

He grasped the controls to steady himself, and shook his head as though to clear it. Some vital part of his plan, he knew, he had forgotten. But he was unable to recall it, or to care. His flagging consciousness was now almost incapable of connected thought. He saw his fingers tighten on the manual controls and slowly, relentlessly, moved by a volition no longer his own, force the deceleration lever over. The ship staggered with the sudden application of braking blasts.

“Kerry! Kerry, let me in!”

The sharp urgency of Hampden’s voice, once more his own since the alien intelligence had bent its attack upon Holm, clanged like a tocsin through the mesmerism which had all but overcome Holm’s own will. One of those rare moments of lucidity brought Holm sharply alive to the desperate reality of the situation. The details of his plan stood forth starkly clear. He flung the deceleration lever back to neutral, returning the ship to the control of its automatic pilot. Acceleration flattened him against the bulkhead as the *Bonanza II* surged cruelly forward. Again the will of alien mentality beat upon his thought.

But the brief respite had strengthened him. Braced against the terrific acceleration, he took an emergency welding unit from its safety socket, aimed its snout against the manual control wiring, and pulled the release trig-

ger. Pale flame belched forth. Bus bars fused instantly in verdant fire, the control current flaring violet across a hundred arcs as the conductors melted through. The ship was under control of its automatic pilot—irrevocably.

Simultaneously that alien mesmerism ceased, faded like the forgotten details of a bygone dream. The unknown knew, then, that further efforts at control would be useless—that Holm could not, if he wished, stay the flight of the *Bonanza II* into the gaping funnel ahead. The automatic pilot held their fate, the fate perhaps of a Solar System, firmly in its steel and copper heart. Even if they destroyed it, the ship would continue straight on its present course, at whatever speed it had meanwhile gained.

Cold sweat dribbled into Holm's eyes and froze on his cheeks. His breath was frosty white. The door latch stuck to his burned fingers as he swung the door open to admit Hampden.

"Into this—quick!" urged the redhead. He had brought the space-suits, and both men donned them as quickly as stiff muscles would permit. Together then, they watched the circular cross section of the Passage widen as the ship plunged toward it.

IN THE ALIEN void ahead there was new movement, a whorl of darkness without shape, colorless as pitch, intangible as space itself. They sensed, rather than saw, it detach itself from the parent continuum as a waterspout lifts from the sea, a vortex of ghastly emptiness.

"A segment of infra-space," muttered Holm. "If it hits us—"

Momentarily it became plainer, as the *Bonanza II* blasted ahead and the yawning blackness of the Passage filled the vision port, that the space segment would strike the ship. It came on as directly as though guiding cords drew it to the vessel.

"We're bound to hit!" groaned Holm. "If they can disintegrate us out here,

before we enter the Passage, the Passage is safe."

"The life-boat?" suggested Hampden, referring to the tiny spaceship cradled against the hull for use in emergency.

"Too late," muttered Holm, his eyes on the approaching space segment. "We'd never get off in time. It doesn't carry enough fuel to get us back anyway. Great Nebulae! There is a chance though—!"

He ripped open the cabinet containing the life-boat release and firing controls. Fitted with directional rockets, the little ship could be released either by its occupants, or from the navigation cubby, and shot either behind the *Bonanza II* or, should the parent ship be falling stern first, over the bow. No alien control sought to hamper him as he set the directional control in the latter position and pushed the ignition switch. Plainly, the unknown was depending upon the strange space-missile to blast the Earthmen out of existence, and no longer interested in probing their minds.

A streak of livid flame raced overhead, the tiny craft's belching exhaust gases purple and crimson against the black opacity of the Passage. With its own acceleration added to the momentum derived from the *Bonanza II*, it forged slowly ahead of the greater ship.

"Hope it's—over—before we get there," chattered Hampden.

As though drawn by invisible elastic cords, life-boat and space segment drew together. They met in soundless collision a scant hundred miles ahead of the *Bonanza II*. For an instant the little vessel seemed oddly transparent, a shimmering, phantomlike multiple image of itself. Green flame ballooned suddenly outward from it, expanded to incredible proportions like a distended, enormous soap bubble, and vanished without residue. No trace remained of either ship or space-segment.

"Clean job!" grunted Holm, the salt

tang of blood on his lips.

"But the Passage——," muttered Hampden. "It's—holding."

It was true. The Passage still loomed before them, now blotting out the star field in all directions. Already they must be within the rim of the funnel—not yet in infra-space proper, but still hurtling toward that borderline where space met space, which life might not pass and live. And the Passage held! Had his guess been so far wrong, Holm wondered, and their effort a colossal, fatal blunder only? Would that alien intelligence dare permit the *Bonanza II* to enter the Passage, and, through it, infra-space? Did it hold their threat to be harmless, and would the ship, exploding in other-space, destroy only itself?

Holm wondered, and the bitter irony of their position struck through more sharply than the cold. They had played their cards—it remained to be seen whether the unknown held trumps, after all. Holm looked at Hampden, sturdily tight-lipped in expectation of death, and, finding nothing to say, knew that nothing needed to be said.

BUT NOW the Passage was *not* the same. It was taking on motion. Like the sucking funnel of a vast whirlpool, its sides drew together as it rotated at incredible speed. It receded, shrank.

"It's going!" shouted Hampden.

As though they were watching the mouth of a cannon from which they had been shot at terrific speed, they saw the Passage dwindle in the remoteness of space. For an instant Holm had a swift, vague impression of depth within its darkness, of dimensions unrevealed.

Then, as they watched that closing of the space breach between infra-world and the world of men, a fierce, glad exultation flowed through them like liquid warmth. Stars prickled the velvet blackness of familiar space. The *Bonanza II* sped freely through its native element.

Hampden stirred, squirmed out of his space-suit, and eyed the damaged manual control wiring.

"A nice mess that is," he grumbled. "We'll barely have it repaired in time for deceleration, when we get there——"

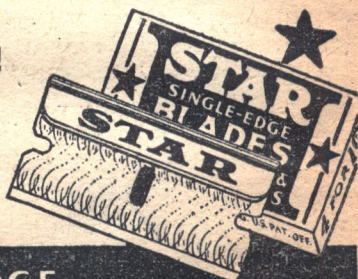
"Get there? We're not headed for home, by a long shot. If you knew anything about navigation, you'd know that we're——"

"—that we're headed smack for Alpha Centauri, because that's what the Passage was lined up with." Hampden grinned knowingly. "Didn't you say Alpha Centauri has cooled? There ought to be some rare ore there—stuff no expedition ever found before. And I always did want to find out what makes a star tick——"



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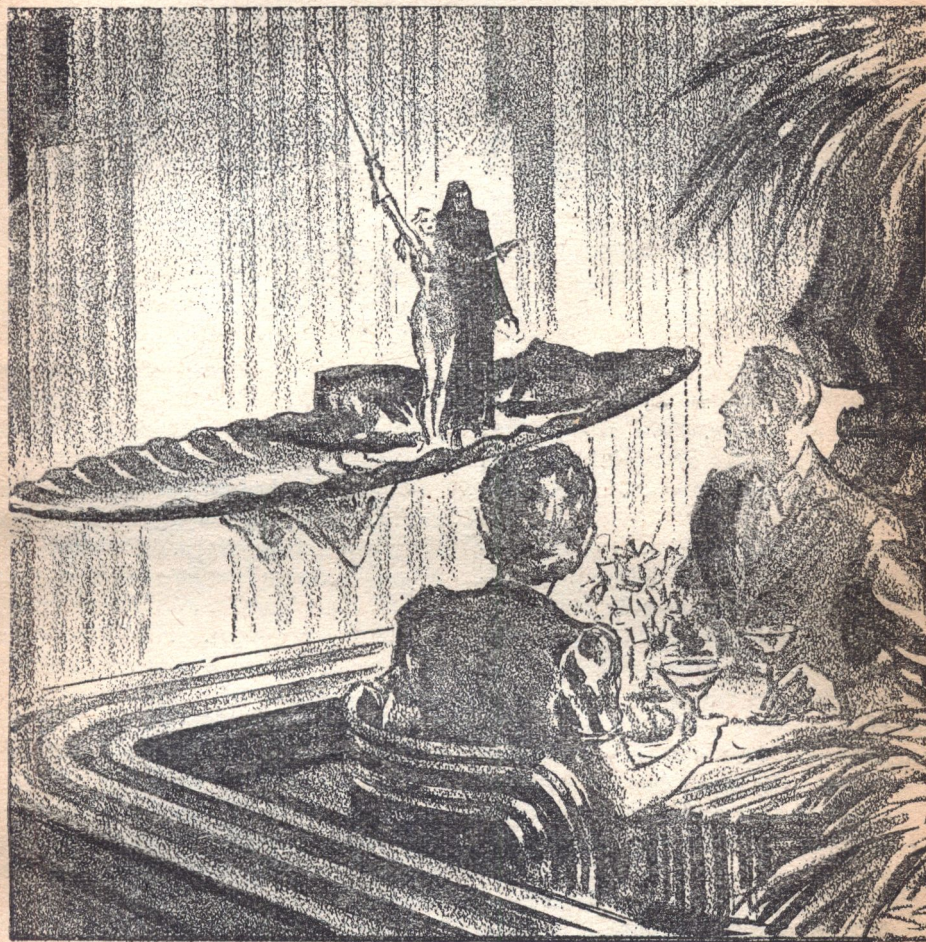


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The Legion Of Time

The second part of a great three-part
NEW-CONCEPT Time story by

JACK WILLIAMSON



"Ho, Queen of Nothingness! Gyronchi has won—Jonbar is destroyed.
We've found a higher crucial factor!"

UP TO NOW:

DEADLY antagonists, two beautiful women haunted Dennis Lanning. He was eighteen, in 1927, when Lethonee first appeared to him in the apartment at Harvard that

he shared with three others: Wil McLan, the mathematician; Lao Meng Shan, the Chinese engineer; and Barry Halloran, all-American tackle and his dearest friend.

Tragic with dread, and beautiful,

Lethonee's intangible image came to him alone, holding the great jewel of Time that she called the chronotron. In it she showed him Jonbar, her city, lying far-off in possible futurity. Jonbar's destiny, she told him, and even her own, were in his hands.

"Don't fly tomorrow," she warned him. "Or Jonbar will be slain!"

Lanning obeyed, because he had fallen in love with her vanishing image. And Barry Halloran was killed in his stead.

Grief-stricken, Lanning left America. And Sorainya appeared to him, floating beside the rail of his ship in the tropics, on her golden shell of Time. Red-mailed warrior queen of Gyronchi, splendid and alluring, she called to him to leap to the shell and return with her to share her throne.

He was about to leap, when Lethonee came back to warn him. For the shell was but an image. He would have fallen to die in the shark-infested sea. Sorainya vanished, angered. And Lethonee explained.

Jonbar and Gyronchi are two conflicting possible worlds, of future probability. Either of them may be made real by the fifth-dimensional progression. But not both. They are fighting for survival. And the choice of reality is in Lanning's hands, Lethonee tells him. She and Sorainya are each beckoning him to carry the choice into her own hall of possible futurity. The choice is his—the outcome veiled in unresolved probability.

Haunted, Lanning walked bewildered through the years. Lethonee guarded his life. Sorainya tried again to lure him to death. He became war correspondent, pilot, soldier—fighting always the right of might. In 1938, flying one night with Lao Meng Shan to defend Hankow from air raiders, he was shot down.

As they plunged down in the flaming plane, dying, a queer, shining ship appeared beside them. Dead Barry Halloran was among the group of men in

assorted military uniforms, who dragged them aboard!

They wake up in the ship's hospital, restored by strange doctors using the mysterious dynat. The others, Lanning learns, have been snatched from death in the same amazing manner. The ship, the Chronion, is to take them to Jonbar. And its captain is Wil McLan.

Going to the bridge for information, Lanning finds McLan strangely aged, scarred from frightful torture. The explanation is interrupted, while the Chronion flashes down into a chaos of fighting battleships. It is Jutland, in 1916! A dying sailor is pulled aboard, rushed to the hospital.

Then Wil McLan, almost voiceless, whispering, tells how he mastered Time, looked into Sorainya's possible future world, and fell in love with her. How she encouraged him to build the atomic-powered time ship, which he finished in 1960.

At once, he had set out down the geodesics of the future to Gyronchi, to join the beautiful Sorainya. Sorainya immediately threw him into her dungeons, turned the Chronion over to the priests of the black gyrane. And laughed at McLan for hoping to win her, warrior-queen of Gyronchi!

Ten years Wil McLan spent in her torture vaults—for he would not give her the secret of the time ship. At last, Lethonee finds him in her chronotron time-scanner, and helps him escape. McLan reaches the time ship, and then Jonbar.

Now, he tells Lanning, they are organizing a Legion of Time to fight for Jonbar and against Gyronchi. But since each represents a different facet of the same age, they are mutually impossible, contradictory. Which will be brought to reality by the progression of the fifth-dimensional axis of Time, depends, in part, on Denny Lanning. Hence, each of the futures is fighting for his services. Since they are mutually exclusive, nei-

ther can directly attack the latter.

But, when Wil McLan tries to look at Jonbar from the chronoscope aboard the *Chronion*, it is beyond his range! Gyronchi has done something, in some time, to diminish the probability of Jonbar. It is so diminished that the *Chronion* may never be able to reach it again!

VIII.

BORIS BARININ came up from the hospital ward. Then two Canadians, lean silent twins named Isaac and Israel Enders, who had been taken aboard, before Lanning left his bed, from a shell hole on the Western Front. And at last Duffy Clark, the British sailor from Jutland.

Willingly taking the oath, they made twelve men under Lanning. He organized them into squads, made big, fearless Emil Schorn his second in command, and began drilling on the deck.

There were arms, he found: a dozen Mauser rifles, two dozen Luger pistols, four crated Maxim machine guns, several boxes of hand grenades, and a hundred thousand rounds of assorted ammunition, which McLan had taken—along with a stock of food and a few medical supplies—from a sinking munitions ship.

"The first precaution," the old man rasped. "We located a torpedoed arms ship when we first came back from Jonbar to collect supplies and weapons—and test our technique of recovery. Weapons from Jonbar, you see, wouldn't function against targets from Gyronchi—mutually impossible! And men who had been eating food from Jonbar, in a raid on Gyronchi, might find themselves—well, hungry."

Lanning superintended the unpacking, inspection, and assembly of the weapons, served out the rifles and automatics, assigned crews to the machine guns. Since McLan's assistants from Jonbar would be unable to enter Gyronchi, he

detailed Clark, Barinin, and Lao Meng Shan as crew for the *Chronion*, and himself learned something of her navigation.

And the time ship drove steadily down the geodesics of Jonbar. The atomic convertors throbbed endlessly beneath the deck. Sometimes Lanning relieved him, but Wil McLan seldom left the control dome.

"The world we seek is now all but impossible," he rasped. "The full power of the field drives us forward very slowly. And at any instant the geodesics of Jonbar may break, for they are weak enough already, and leave us—*notime!*"

Once, in his tiny cabin aft, Lanning woke in his bunk with a clear memory of Lethonee. Slim and tall in her long white robe, she had stood before him, holding the flaming splendor of the *chronotron*. Despair was a shadow on her face, her violet eyes dark pools of pain.

"Denny," her urgent words rang clear in his memory, "come to Jonbar—or we are dead."

Lanning went at once to the bridge, and told McLan. The old man shook his white head, grimly.

"We are already doing all that can be done," he said. "The geodesics of Jonbar are like microscopic wires drawn out thinner and thinner by the attenuation of probability. If the tracer loses them, or if they snap, Jonbar is—lost."

Helpless, Lanning could only return to the drilling of his men.

TWO WEEKS passed, by the time of the ship—physiological time, that measured by heartbeats and all bodily rhythms, in which the span of life moved relentlessly toward its end, regardless of motion backward or forward along the time dimension. And at last the *Chronion* slipped silently out of the blue, shimmering abyss. Lanning, waiting eagerly on the deck, saw beneath them—Jonbar!

The ship was two miles high. Yet,

so far as his eye could reach in every direction, stretched that metropolis of futurity. Mirror-faced with polished metal, the majestic buildings were more inspiring than cathedrals in their soaring grace. With a pleasing lack of regularity, they stood far apart all across the green parklike valley of a broad placid river, and crowned the wooded mills beyond. Wide traffic viaducts, many-leveled, flowed among them, busy with strange, bright vehicles. Coming and going above the towers, great silver teardrops swam through the air about the ship.

Lanning had glimpsed it once before, through Lethonee's jewel. But its majestic reality was new. The staggering vastness and the ordered splendor of it shook him with a kind of awe. Hundreds of millions, he knew, lived here, labored, loved, rejoiced in the happiest estate that mankind had ever known—or, he realized, he should put it, might ever know. And all the wonder of this world, the incredible fact came to him stunningly, was faced with absolute annihilation.

Trembling with eagerness and dread, he hastened up to Wil McLan.

"This is Jonbar!" he cried. "Then it's still—safe? And we can find Lethonee?"

The bent old man turned solemnly from the polished wheel, and shook his scarred white head.

"We're here," came his grave, voiceless whisper. "But only the geodesic analyzers can measure the degree of Jonbar's probability. It hangs by a strand weaker than a spider's web. Lethonee will doubtless be at her new laboratory."

The *Chronion* was gliding swiftly down to a mile-high argent spire—that soared from a wooded height—propelled in space, McLan had explained, by the same special field that moved it in Time. A vast doorway slid open in a silvery wall. The little ship floated into an immense hangarlike space, crowded with

streamlined craft. A green light beckoned them to land on an empty platform.

"This is the world we must fight to save," Lanning told the men.

"*Ach!*" rumbled Emil Schorn. "It is a good world, well worth fighting for."

Leaving the big Prussian in command, and warning him to be ready for instant action in case of emergency, Lanning and McLan left the ship. An elevator in a great pillar shot them upward. They emerged into the cool refreshment of open air, amid the gay verdure of a terrace garden. A sliding door opened in a bright wall beyond. Tripping eagerly out of it, to meet them, came Lethonee.

Instead of the long white robes in which Lanning had always seen her, she wore a close-fitting dress of softly shimmering, metallic blue, and a blue band held her dark ruddy hair. Something of the grave solemnity of the apparitions was gone. She was just a lovely, human girl, joyously eager to see him—and trying, he thought, to hide a tragic despair.

She came quickly to him, through the bright garden, and took both his hands in an eager grasp. And Lanning felt a queer little shiver of joy at the warm reality of her touch.

"DENNY LANNING!" she whispered. "At last you have come. I am so glad——"

Her weary, troubled eyes went to scarred old Wil McLan.

"Gyronchi has carried out some attack," she told him gravely. "A warning came from the *dynon*, and now—they are gone. The full power of the *chronotron* will not penetrate forward, beyond tonight."

Her voice was hushed and shaken; in her eyes was the shadow of doom.

"I have been with them twenty hours in the laboratory. But we could discover nothing. Only that this is the last possible night of Jonbar. Unless——"

Her haunted eyes clung desperately to Lanning's face.

"Unless the tide of probability is changed."

Wil McLan limped toward the sliding door, breathing huskily. "I'm going up to the laboratory."

Lanning lingered, and his thirsty eyes caught the girl's.

"I have done all I can, there," she said. "And, if this is the last day of Jonbar, I should like to spend an hour of it with you, Denny. Perhaps the only hour we shall ever have together."

"I'll send for you, Denny, if we discover anything," rasped McLan. "You can do nothing, until—unless—we find what action Gyronchi has taken."

He turned through the sliding door.

Alone on the terrace with Lethonee, Lanning was overcome with a sense of incredulity. He looked wonderingly at her grave quiet beauty, framed in the greenery, asking, "How can I believe that you aren't real? What is the difference between reality and such a seeming as this?"

"The universe of reality, determined by progression on the fifth axis, is simple and complete," the girl told him solemnly. "All the branching geodesics of possibility tend to pick up energy; all possible worlds strive for reality. But only one line, at each bifurcation, can win. All energy is withdrawn from those other, half-formed worlds, as the world lines of the victorious one are fixed in the fifth dimension. And it is as if they had never been."

Her white face was very sober.

"In a manner of speaking, all the seeming reality of Jonbar—even I—was given creation by the atomic power of the *Chronion*, bringing you down the geodesics. We are only an illusion of possibility, the reflection of what may be—a reflection that is doomed!"

Abruptly, then—and Lanning knew that it took a desperate effort—she

tossed her lovely head, and smiled.

"But why need illusions talk of illusion?" The silver voice was almost gay. "Aren't you hungry, Denny? Gather flowers for the table, and let us dine—on illusion!"

WITH HER own hands she set a small table at the rail that edged the terrace. The huge white buds that Lanning picked bathed them in a delicate perfume. Beyond the rail, and a mile below, stretched the green parklands. Other silver pylons shimmered magnificent on distant hills. The genial sun was setting from a serene sky, of a blue clarity that Lanning had never seen above a city. A cool wind whispered across the garden, in a silence of ineffable peace.

"Nothing can happen to you, or to Jonbar, surely," whispered Lanning, sipping a glass of fragrant wine. "Perfection cannot die!"

"But it can." Her voice shuddered. "When the whole continuum is tortured with forces in conflict, who can foretell the outcome?"

Lanning caught her hand. "Lethonee," he said huskily, "for ten years of my life, since the first night you came to me, I have lived in hope of finding you. Now, if anything should take you——"

An iron grasp closed on his throat.

The girl moved closer, shivering. "But we know," came her dread-chilled voice, "that this is *the last night of Jonbar*. The *chronoton* can discover no possible tomorrow!"

The blue dusk turned to mauve and to purple-black. The far towers of Jonbar shone like pillars of fire. And the roadways, sweeping through the dark woodlands, were broad, brilliant rivers of flowing light.

Shadows filled the terrace. Some night-blooming shrub sent out a flood of intoxicating sweetness. Slow music

came softly from somewhere below. Close to Lethonee, Lanning strove vainly to forget the torturing pressure of peril, sought to grasp and hold her threatened reality with the strength of his arms.

Suddenly the girl's hand stiffened in his, and she caught a gasping, frightened breath.

"Greetings!" rang out a voice of golden mockery, "Queen of Nothingness!"

LANNING looked up, startled. Above the terrace, floating as he had seen it before, was a long, shallow, golden shell. Sorainya stood in it, proudly erect in a long-sleeved shirt and kilt of woven scarlet mail. Beside her stood a tall, angular man—gaunt-faced, with dark, sullen eyes and cruel, heavy lips—robed to his feet in dull, stiff black.

Glarath, the latter must be, Lanning knew, high priest of the strange *gyrane*. His sunken black eyes smoldered with a malevolent flame. But Sorainya's greenish glance held a mocking amusement.

"Best taste her kisses while you may, Denny Lanning," she taunted. "For we have found a higher crucial factor. I didn't need you, Denny Lanning, after all—Glarath, with the *gyrane*, took the place I offered you. And now the struggle is won!"

The black-haired hand of the priest clutched possessively at her strong, bare arm. He snarled some guttural, unintelligible word, and his dark eyes burned at Lanning, terrible with hate.

Sorainya whipped out the thin golden needle of her sword, and drew it in a flashing arc above the dark city. And she leaned into the black priest's arms.

"Farewell, Denny Lanning," pealed the mockery of her shout. "And take warning! All Jonbar—and the phantom in your arms—will be gone before the wind. We have come to watch the end."

With the hand that held the sword, she flung him a derisive kiss. Her foot touched some control, and the shell soared upward and vanished in the sky of night.

White-faced, shaken, Lethonee was on her feet. "Come to the laboratory!" Her voice was dry with alarm. "I hadn't meant to stay so long."

Lanning followed her to the sliding door. Beyond it, he glimpsed a vast tower room. At endless tables, hundreds of men and women were busy with mathematical instruments: calculating machines, planimeters, integrators, and harmonic analyzers. Beyond was a huge bulwark of intricate mechanism, resembling a magnified version of a product integrator Lanning had seen at the Massachusetts Tech, capable of solving problems too complex for the human brain. Beyond, in a far wing, pedestals supported scores of huge crystals like the *chronotron* screen Lanning had seen in the hands of Lethonee. Swift activity hummed everywhere.

BEFORE they had entered, however, Wil McLan came to meet them at a frantic, limping run. His white hair was wild, a desperate urgency strained his haggard face.

"Back, Denny!" It was a rasping, whispered scream. "Get back aboard. Jonbar is—going!"

Lanning swept Lethonee with him into the elevator. McLan tumbled after them. The cage dropped toward the hangar. Lanning held the girl in quivering arms.

"Darling——" he whispered. "You are coming with us!"

She shook her tragic head. "No, Denny. I am part of Jonbar." She clung to him, desperately.

The elevator stopped. Lanning caught Lethonee's hand, and they ran out across the hangar, toward the *Chronion*. Ahead, Lanning saw a welcoming throng of gay-clad people gathered about

the time ship, tossing flowers to the deck. Dapper Jean Querard stood by the rail, making a speech.

But a curious dim, silver light was beginning to steal over the crowd and the teardrop ships and the walls, as if they were beginning to dissolve in a silver mist. Only the *Chronion* remained clear, real.

Lanning sprinted.

"Hurry!" he sobbed. "Darling——"

But Lethonee's fingers were gone from his hand. He stopped, and saw her still beside him—but dim as a ghost. Frantically, her shadow beckoned him to go on. He tried to catch her up in his arms. But she faded from his grasp. She was gone.

McLan had passed him. Lanning caught a sobbing breath, and fought a blinding pain, and stumbled on—— But what was the use, demanded bitter agony, if Lethonee was gone?

Everything but the *Chronion* was dim now. Beginning to flicker like the blue abyss in which the time ship rode. He saw Wil McLan scramble up a ladder. But the floor was giving way. His running feet sank deep, as if its metal had been soft snow——

And it was gone. Lanning caught his breath, and clutched out desperately, and fell. The last wraith of the building flickered away. Jonbar was gone. Beneath, under the empty night, lay only a featureless dark plain. And Lanning was plunging unchecked toward it, a cold wind screaming up about him.

A malicious golden voice pealed: "Farewell!"

And Lanning saw the long yellow shell flash by, Sorainya and Glarath lying together on its cushions. He fell past them, and the icy wind took his breath.

Then the *Chronion* shot down beside him. The yellow ray flared from her crystal gun, and drew him headlong to the rail. And Barry Halloran, laughing, hauled him safely aboard.

IX.

THE SHIP, in a moment, was back in her timeless blue abyss, driving through the ceaseless flicker of possibility. Lanning hastened to join Wil McLan beneath the crystal dome, and asked a breathless, tortured question: "Lethonee is gone—dead?"

The sunken, haunted eyes looked at him solemnly.

"Not dead," rasped Wil McLan, "for she was never born. Jonbar was merely a faint probability of future time, which we illuminated with the power of the temporal ray. This last triumph of Sorainya has—eliminated the probability. The reflection, therefore, vanished."

"Sorainya!" gasped Lanning. "What has she done?" He clutched a twisted arm. "Did you discover anything?"

The white head nodded.

"In the last hour, before the laboratory was obliterated——"

"You did!" Lanning quivered with impatience. "What was it?"

"A moment, my boy," came the whisper. "It seems that the priests of the *gyrane* must have learned more from the study of the *Chronion* than I thought. Sorainya's golden shell, as you know, is merely an image projected by the temporal ray. But now Glarath has built an actual time ship!"

"Eh?" muttered Lanning.

"It is similar to the *Chronion*, but heavier and armored. And it carries a horde of Sorainya's fighting ants."

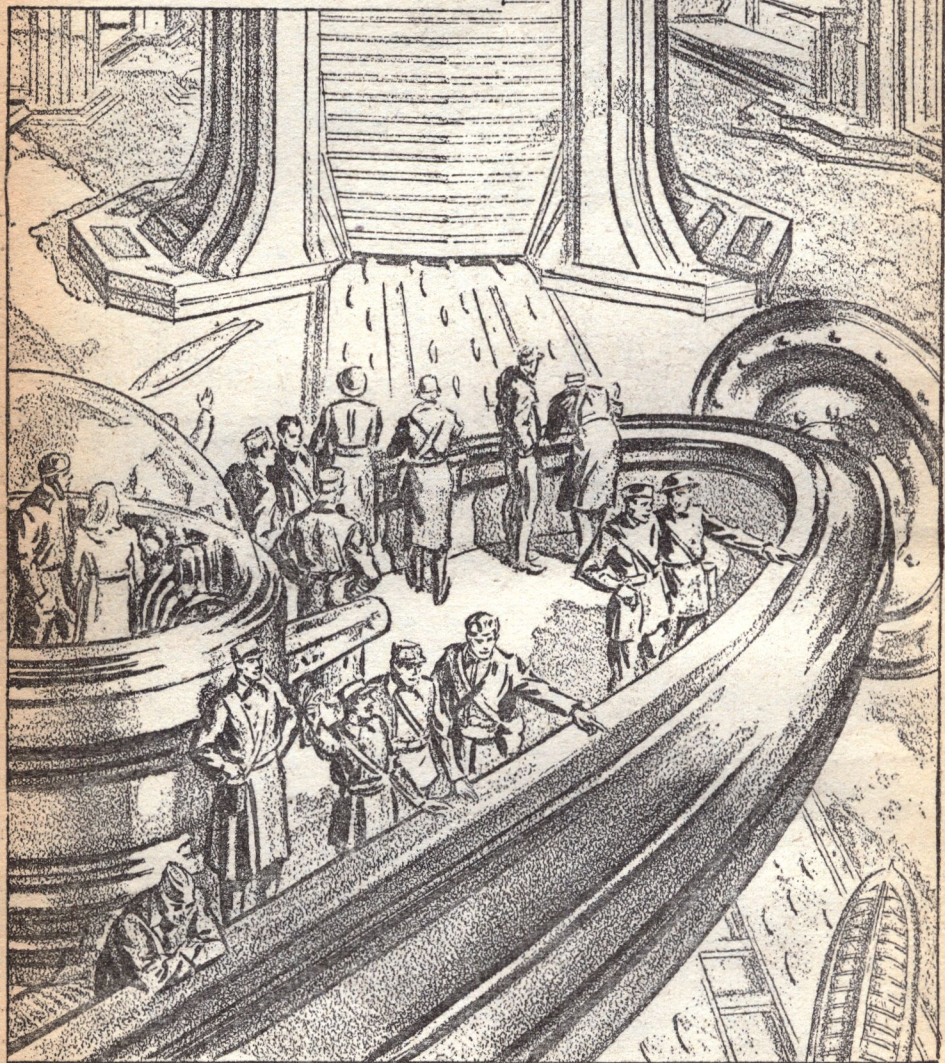
"And they used that, against Jonbar?"

"They went into the past," said the voiceless man. "Back to the turning point of probability. They found something there—it must have been a small material object, although we failed to glimpse it with the *chronotrons*—which was the very foundation of Jonbar. Using the power of the *gyrane*, they wrenched the thing, whatever it was, out of its place in time. The resulting warp of the geodesics extinguished the possi-

bility of Jonbar."

"What did they do with the thing?"

"They kept it concealed, so that we could get no sight of it with the temporal ray. And they carried it back to Gyronchi. It is guarded, there, in So-

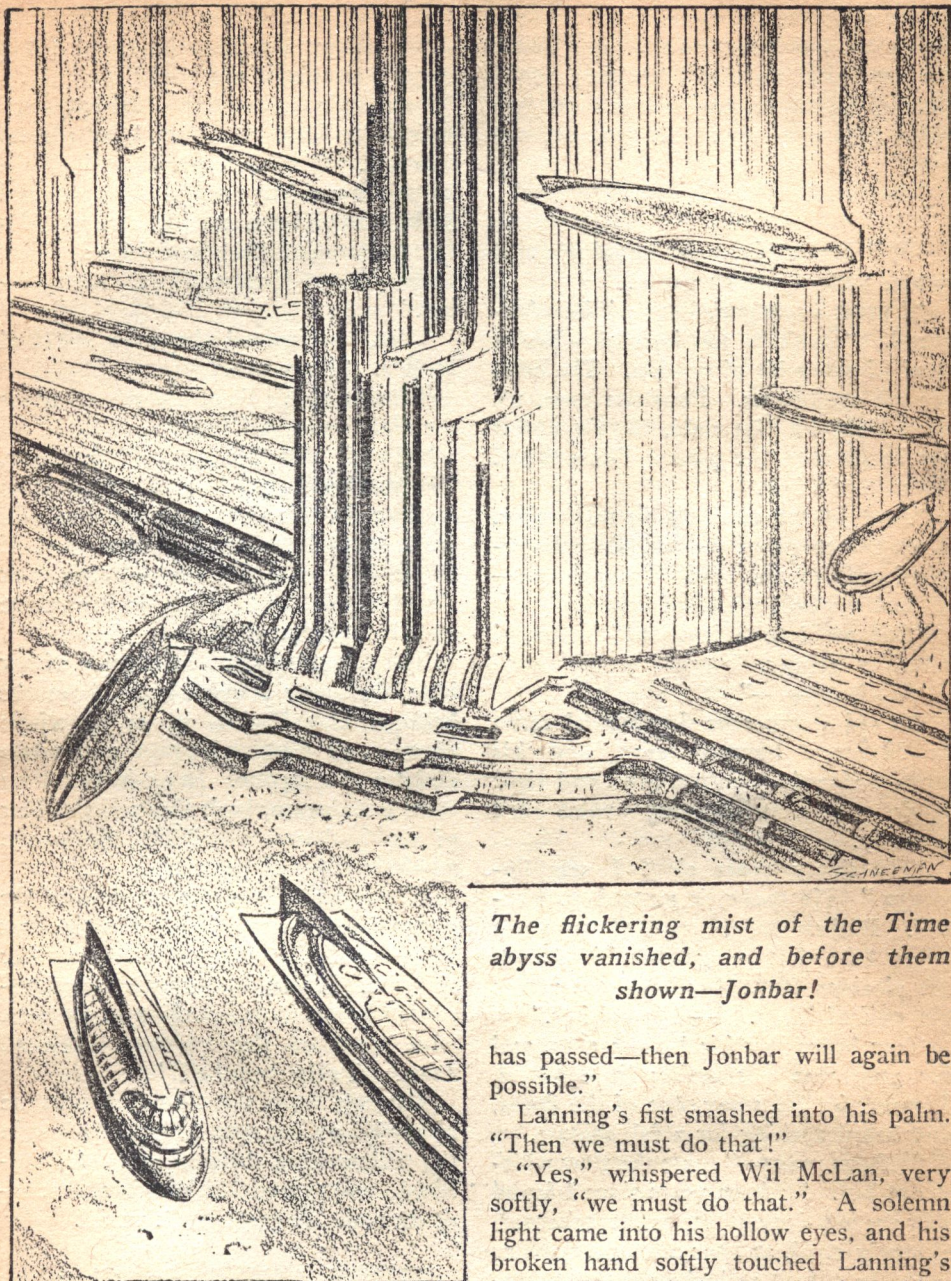


rainya's fortress."

"Guarded?" Lanning echoed. His fingers twisted together in a sudden agony of hope, and his eyes searched McLan's wealed face. "Then if we took it—" he gasped desperately, "brought

it back—would that help Jonbar?" Urgently, he seized McLan's thin shoulder. "Can—can anything bring back Lethonee?"

The haggard white head moved in a tiny nod.



The flickering mist of the Time abyss vanished, and before them shown—Jonbar!

has passed—then Jonbar will again be possible.”

Lanning’s fist smashed into his palm. “Then we must do that!”

“Yes,” whispered Wil McLan, very softly, “we must do that.” A solemn light came into his hollow eyes, and his broken hand softly touched Lanning’s arm. “Yes, this is the task for which we gathered your Legion, Denny—although the details have not been clear until now.”

“Then,” Lanning cried eagerly, “let’s go!”

“Now we are retracing the faded geo-

“Yes,” came his slow, hoarse whisper. “If we can recover the object; if we can discover where they found it, in Space and Time; if we can put it back there; if we can prevent Gyronchi from disturbing it again until the turning point

desics of Jonbar," the old man told him, "back toward your own time. There we can pick up the branching world lines of Gyronchi, and follow them forward again, to seek that guarded object."

"And let Sorainya beware!"

BUT McLAN caught Lanning's arm again, with a firmer grasp.

"I must warn you, Denny," he whispered. "Don't be too hopeful. We've need of every bit of caution. The odds are all against us. Fourteen men, we must fight all Gyronchi, Sorainya and her battle ants, the *gyrane*, Glarath and his ship of Time.

"And Jonbar can help us no farther. Even the surgeons we had aboard vanished with all the rest. Twice seven—against a whole world of futurity."

"But we'll take 'em on!" muttered Lanning, grimly.

"We'll try——"

An old slumberous fire burned again in McLan's haunted eyes, and his seamed face drew into a grim and rigid mask. His whispering voice fell hoarsely.

"It's thirty years since I saw Sorainya." He spoke, it seemed, to himself. Broken fingers touched the worn silver tube that hung from his throat. "A glorious flame that lured me across the gulf of Time. I—I loved her."

Tear burst into his hollow eyes, and his gulp was a startling little sound. Lanning looked away, out of the dome, and heard nothing for a full minute.

"Fifteen years——" came the slow whisper at last. "Fifteen years since I found that she is a demon. Lying, treacherous, savagely cruel, as near a female devil as could be. And still—beautiful. Somehow, glorious!" Some deep-hidden agony throbbed in his whisper.

"I hate Sorainya!" It was a savage rush. "She tricked me, tortured me, maimed me forever! She—she——" Something seemed to choke him. At

last came the voiceless sigh: "But still—for all her hateful evil—could I kill Sorainya? Could any man?"

Lanning's fists were knotted into hard balls. "I have seen her," he gasped hoarsely. "And I don't know." Then he strode suddenly across the room and back, moved by a tearing agony. His voice quavered thin and high: "But we've got to—if we can! To save Jonbar."

"Yes," whispered the man she had broken. "If we can."

A week, ship's time, had passed when the dials registered 1921.

"Here," Wil McLan told Lanning, "the last broken geodesic of Jonbar joins reality. In this year, it is just possible, we may find the apex of that cone of probability formed when Glarath took the object out of time—if we ever come back from Gyronchi."

The *Chronion* came briefly out of her blue, flickering bourne, high above the brilliant blue Pacific, where the circle of an atoll glistened green and white about a pale lagoon. In an instant they were gone again, back through the blur of multitudinous possibility, down the geodesic track of Gyronchi.

Lanning and Schorn were drilling the men "daily" on the deck. But the first brush with Gyronchi came as an utter surprise. It was jaunty little Jean Que-rard, leaping from his place in the line, who screamed the warning. "*Grand Dieu!* A ship from hell!"

Turning from the little rank, as he pointed, Lanning saw a black shadow in the shimmering blue abyss. It vanished, reappeared, flickered, was suddenly real. A great black vessel.

THREE TIMES the *Chronion's* length, it was thick and massive. Its ends were two immense square plates, which shone with the same greenish glow as the *Chronion's* polar disks. Black muzzles frowned from ports in her side, and the high bulwarked deck

was crowded with a black-armored horde of Sorainya's gigantic ants, aglitter with golden axes and thick, crimson guns.

On a lofty quarter-deck, Lanning thought he glimpsed the black-robed angularity of Glarath. But it disappeared. And, a moment later, a dazzling white beam jetted from a projecting tube. A two-foot section of the *Chronion's* rail turned blindly incandescent and incontinently exploded, flinging out searing drops of molten metal.

"Lie flat!" ordered Lanning. "Fire at will!" He shouted to Schorn: "Get the Maxims going!"

But what—the question racked him—could lead avail against that beam of terrible energy? Rifles and machine guns crackled as he ran to the speaking tube that communicated with McLan.

"Wil!" he yelled. "What can we do?"

The white sword flashed again behind him. And Israel Enders, kneeling to fire, collapsed in a smoking heap. There was one dreadful scream, agony-thinned. And then bright flame burst up from the pile of burnt cloth and seared flesh and fused metal that had been a man.

With an answering scream that was the echo of his brother's, Isaac Enders fed a belt of ammunition into his Maxim, and sprayed lead at the far rank of hyper-ants who were leveling their red-metal guns. Projectiles splattered the *Chronion*.

The hoarse, tortured whisper came back from Wil McLan. "The *Chronion's* no fighting ship. We can't meet the ray of the *gyrane*."

"What then?" It was a gasp of agony. "They've got Israel Enders, already—"

"Outrun them!" came the voiceless husking. "The only hope. The *Chronion's* lighter. Hold them off. And maybe—"

Blinded by blood from a wound on his forehead, the Austrian, Arneith, was fumbling with his jammed Maxim.

Lanning ran to take the gun, seared his fingers freeing the hot action, and trained it on the port from which the ray had flashed. Perhaps, if it came from some sort of projector that could be broken——"

He hammered hot lead at the black-armored ship. It was drifting nearer. Another volley from the ants screamed above. The white ray flashed again. One of the Maxims exploded, splattered fused metal. Willie Rand, behind it, rolled moaning on the deck, beating with blackened hands at his flaming garments.

This couldn't go on! Shuddering, Lanning fed another belt into his smoking gun. A few of the great ants had fallen. But the battle was hopeless. He listened. Was the throb beneath the deck a little swifter?

The great black ship was close when his gun clattered again. Swinging their golden axes, the mighty ants lined the rail. Were they preparing to board? Lanning tilted up the Maxim, to rake them.

A thick black tube crept down, stopped in line with him. His breath caught. It was time for that flaming ray. A stabbing, blinding flash——

BUT THE TIME SHIP had flickered, like a shadow of black. And it was gone in the shimmering abyss. Dazzled, reeling, Lanning left his hot gun and stumbled to the speaking tube.

"Wil?" he called, shakily.

"We've outrun them, Denny," came the voiceless rasp. "Though it took our full field potential. We can keep a little ahead, along the time dimension. But they'll be back to Gyronchi ahead of us, by a seeming paradox, to warn that we are coming.

"What are our casualties?"

Lanning turned to survey the littered deck. The tall, grim-faced Canadian was on his knees beside the smoking remains of his brother, sobbing. Barry Halloran was dressing Von Arneith's

wound. And Willie Rand, blackened, his clothing still smoking, was groping his way about the deck, cursing in a soft, weary monotone. Lanning saw his eyes, and chilled to a shock of horror. For, staring wide and blank from his red-seared face, they were cooked white from the ray, blinded.

"Israel Enders dead," he reported to McLan, in a sick voice. "Arneith wounded. Rand blind. And one Maxim destroyed. That terrible ray——"

"That was the *gyrane*," rasped McLan. "And but a hint of what the *gyrane* can do. The odds are all against us, Denny. We must avoid another battle—if we can. But now that they are warned——"

The whisper faded, on a note of tired despair.

Wrapped in a sheet, to which was pinned a tiny Canadian flag and the silver star of Jonbar, the remains of Israel Enders and his fused rifle were consigned to the shimmering gulf of Time—where, McLan said, having the velocity of the ship, they would drift on into ultimate futurity.

The deck was cleared, the broken rail mended, the guns cleaned and repaired. Atomic converters throbbing swiftly, polar plates shining green, the *Chronion* plunged on down the track of probability, toward Gyronchi.

Erich von Arneith came up from the hospital, with a new grimness on his lean dark face and a livid white scar across his forehead.

Asking for a Mauser whose lock was broken, Willie Rand sat for long hours on the deck, bandaged head bowed, whetting the gleaming bayonet and testing its keenness with his thumb.

On the bridge, Lanning and Wil McLan peered for long hours into the crystal block of the *chronoscope*, using its searching temporal ray to scan Gyronchi, seeking an opportune moment to check the time ship, for the raid. Some strange force, however, made it impossible to

look actually into Sorainya's mighty citadel, to find the object they sought to recover.

"Another application of the *gyrane*," rasped Wil McLan. "An interfering sub-etheric field, set up about the metal walls, that damps out the temporal radiation." A stern light glinted in his hollow eyes. "But I know Sorainya's fortress," he whispered grimly. "With Lethonee's aid, planning that escape, I memorized every inch of it."

His broken fingers drew maps and plans. He and Lanning and Schorn pored over them, hour after hour.

"It must be a sudden strike," he husked, "with the hour well-chosen. A moment lost—a wasted step—may mean disaster. The great strong room, where Sorainya keeps her treasure, is in the eastern tower. It is reached only by an elevator, through a trap door in the floor of Sorainya's own apartments. And the great hall outside, through which you must go, is guarded always by scores of ants."

And at last Wil McLan spun the shining wheel and tapped a key, to stop the time ship in Gyronchi.

X.

IT WAS the somber dusk of a cloudy day when the *Chronion* first paused in the land that Lanning had seen in the crystal screen of the *chronoscope*. The tiny fields, the broad river dully silver in the twilight, sprawling miserable villages—and a blackened, barren patch where one had stood. The twin hills beyond, bearing the temple of the *gyrane*, with that awful vortex of black still funneling out into space above its squat and somber colonnades. And Sorainya's citadel.

Standing on the deck, Lanning scanned the fortress through powerful binoculars. Mountainous, frowning pile of eternal crimson metal, ancestral fastness of Sorainya's warrior dynasty—he

knew from the *chronoscope*—for half a thousand years. Scores of the black-armored ants, agleam with the gold and scarlet of their weapons, were marching in sentry duty along the lofty battlements. And Lanning saw, mounted cannonlike upon the walls, a dozen of the thick black tubes that projected the deadly ray of the *gyrane*.

"*Gott im Himmel!*" rumbled Emil Schorn at his side, awed. "Der thing we must recover is in that castle, *nein?* It looks a *verdammt* stubborn nut to crack!"

"It is," said Lanning. "One slip, and we are lost. There must be no slip." He handed the glasses to the big Prussian. "We have only paused here to look over the ground by daylight," he swiftly explained. "We are to land after midnight on that ledge that breaks the north precipice—see it?"

"*Ja!*"

"Sorainya herself will then be gone to visit Glarath in his temple—so we saw in the *chronoscope*. And perhaps at that hour her guards will not be too alert. Our landing party must climb to the little balcony above, where the skeleton hangs——"

"*Ach, Gott!* A dizzy climb!"

"The little door on the balcony gives into the dungeons. Wil McLan has the keys he carved there, for his escape. We'll enter through the dungeons, and try to reach the great hall above. Is the plan all clear?"

"*Ja,*" he rumbled. "Clear as death."

Lanning waved his arm to Wil McLan, in his crystal dome, and the mote of the *Chronion* flashed again into her shimmering gulf.

The landing party gathered on the foredeck. Including Lanning and Schorn, it numbered eight men. A grim, silent little band—save for Barry Halloran, who tried to make them join in his roaring chant of "Jonbar!"

Isaac Enders and Von Arneth packed two of the Maxims, Cresto and Court-

ney-Pharr were burdened with the fifty-pound tripods. The others were laden with climbing ropes, rifles, grenades, and ammunition for the Maxims.

Boris Barinin set up the remaining gun to guard the ship. And blinded Willie Rand sat silently beside him, breathing white cigarette smoke and whetting at the bayonet of his broken gun.

The *Chronion* plunged again into the blackness of a wet midnight. The overwhelming mass of Sorainya's citadel was a vague shadow in the clouds as the time ship slipped silently down to the narrow, lofty ledge. A cold rain drizzled on the deck, and a bitter wind howled about the unseen battlements above.

Noiseless as a shadow, the *Chronion* settled among the gnarled and stunted brush that clung to the ledge. Limping down from his bridge, Wil McLan handed Lanning the three white keys that he had carved from human bone.

"This is the balcony door," came his voiceless rasp. "The master key. And the inside gate. But I have none for the strong room—you must find another way." His broken hand gripped clawlike on Lanning's arm. "I've told you all I can, Denny." The whisper shuddered. "You'll pass through the prison where I lay for ten years—where we may all rot, if you fail. Don't fail!"

Lanning grasped the quivering, twisted shoulder.

"We can't fail—Jonbar."

BURDENED with Mauser, coiled rope, and a hamper of grenades, Lanning led the way over the rail and up the precipitous cliff. The mossy rock was slippery with mist. Wet cold pierced him, numbing. The wind tugged at him with icy, treacherous hands. In the darkness he could see nothing save bulking vague shadows; he had to fumble for the way.

Knives of granite cut his fingers, and

damp cold deadened them. Once he slipped, and clawed at the sharp rock to catch himself, scraping flesh away. An age-long instant, heart still, he hung by the snapping fingers of one hand.

But he recovered himself, and climbed on. He came at last to a stout little oak, well anchored in a crevice, which he had marked through the binoculars. He knotted a rope to it, tested its strength, and dropped the coil to the men below.

He climbed again. A wild gust of wind tore at him. The rain, in bigger, colder drops, drenched his numb body. Pale lightning flashed once above, and he chilled with dread that it should reveal them.

He fastened another rope about a projecting spur of rock, dropped it, and climbed again. Stiff, trembling with physical and nervous fatigue, he came at last to the narrow rugged ledge where the precipice of stone joined the sheer, unscalable precipice of crimson metal. Wedging his bayonet, stakelike, in a fissure, he anchored another rope, and then began to inch his way along the ledge.

Then he heard a stifled scream beneath. A long silence. Something crashed, faintly, far below.

Shuddering, Lanning waited, listening. The storm moaned dismally about the battlements, still hundreds of feet above. There was no alarm. On hands and knees, he crept onward.

"*Ach, Gott!*" came a hushed rumbling. "This *verdammte* blackness—it would blind der deffil!"

And Emil Schorn came swarming up the rope behind him, and followed along the ledge. They came to the little projecting balcony of rusted red metal. A gallows arm projected above it. A rope hung through an open trap door, and beneath it, swaying in the wind, hung white bones in jangling chains.

As Lanning tried the thin bone key in the metal door, the other men joined

them, one by one, breathless, dripping, shivering with cold—all save the Austrian, Von Arneth.

"*Madre de dios!*" shuddered the Spanish flyer, Cresto. "He fell past me, screaming. He must have splashed, at the foot of the mountain! *Cabrón!* It leaves us but one Maxim."

The massive plate of the door slid aside, and a fetid breath came out of Sorainya's dungeons. The stench of unwashed human misery, of human waste and mouldering human flesh, mingled with the suffocating acrid pungence of the great ants. Clenching his jaw against the sickness in his stomach, Lanning led the seven forward.

At first he could see no light in the dungeons. He led the way by touch alone through the narrow, rock-hewn passages, counting his steps and fumbling for the memorized turns. But presently he could see a little, by a phosphorescence of decaying slime that patched the walls and floors.

Beyond the bars of cells he glimpsed abject human creatures, maimed, blinded, livid with wounds of torture. The bones of the dead, sometimes shining with a cold, blue luminous rot, lay still chained in the same cells with the living.

A DREADFUL silence filled most of the prison. But from one cell came an agonized screaming, paper-thin from a raw throat, repeated with a maddening monotony. Glancing through a barred door, as he passed, Lanning saw a woman stretched out in chains on the floor. A crystal vessel swung back and forth, above her, pendulumlike. And drops of cold green fire fell from it, one by one, upon her naked flesh. With each spattering, corrosive drop, she writhed against the chains, and shrieked again.

The half-consumed body, Lanning thought, might once have been beautiful. Could this have been some rival

of Sorainya's? A cold hate turned him rigid, and quickened his step. A muffled shot echoed behind him, and the screaming stopped.

"*Mon cœur!*" whispered little Jean Querard. "She shall suffer no more."

In another cell was a great squeaking and thumping commotion. And Lanning glimpsed huge, sleek rats battling over a body in chains, newly dead, or dying.

Once, beyond, that situation was reversed. A sightless, famished wretch had bitten his own wrist, to let a few drops of blood flow upon the floor. He crouched there, listening, and snatched again and again, blindly, with fettered hands, at the great wary rats that came to his bait.

"My word!" gasped the British flyer, Courtney-Pharr. "When we meet that fascinatin' she-devil, she'll account for all this. Rather!"

Lanning stopped, at a turning, and called back a soft warning: "Ready, men!"

With a little jingle of their weapons, two of Sorainya's warrior-insects came down the corridor. Hypertrophied ants, walking erect on two angular limbs, eight feet tall. Their great eyes gleamed lambent in the darkness, strange jewels of evil fire.

"Bayonets!" whispered Lanning. "No noise."

But his own bayonet had been left back on the precipice to hold the rope. He clubbed his rifle, to lead the rush, swung it down to pulp a compound eye. Taken by surprise, the monsters reeled back, snatching with strange claws for their weapons.

The ants were mute. But little red boxes, clamped to their heads, might, Lanning thought, be communicators. A black limb was fumbling at one of them. He snapped down the rifle in a second hasty blow, crushed it flat between stubby antennæ.

Ugly, powerful mandibles seized the

Mausers' butt, sheared through the hard wood. And a mighty golden battle-axe came hissing down. Lanning parried at it with the barrel of the broken gun, but the flat of its blade grazed his head, flung him down into fire-veined blackness.

He lay on the floor, dazed and nerveless. Red agony splintered his temple. Yet he retained a curious detached awareness. He could see the weird feet stamping about in front of his face, on the faintly glowing slime. The reek of formic acid stung his nostrils, burning out the nauseating effluvium of the cells. The ants fought silently, but their limbs and chitinous armor made odd little clicks and creaks.

THE MEN had swept forward after Lanning, with bayonets set. They were dwarfed by the four-armed monsters. And, in a moment, the advantage of surprise was gone.

"*Vive Jonbar!*" sobbed Cresto. And the dexterous sweep of his blade completely decapitated the nearer ant. Insect physiology was not so quickly vanquished, however. The headless thing remained for a moment upright, and the great yellow axe struck again, bit deep into the Spaniard's skull.

"*Dios—*"

His gaunt body lurched automatically forward, and came down on top of the ant's, driving the bayonet deep into the armored thorax.

Emil Schorn's weapon had driven into the monster Lanning had half-stunned, with a force that carried it over backward. Barry Halloran followed him, with a ripping lunge. The battle was ended.

Barry helped Lanning to his feet, and he stood a moment swaying, fighting for control of his body. Courtney-Pharr produced a silver flask of brandy, splashed its liquid fire on his temple, gave him a gulp of it. His spinning head cleared. He seized Cresto's rifle,

jerked the bayonet from the great ant's body, and staggered on, following Emil Schorn.

An outstretched hand and a whispered warning stopped him in the darkness. Greenish light shone through massive bars ahead. He crept up beside Schorn, and looked into a long guard room.

A dozen of the ants were lounging in the room, and the air was thick with their acid smell. Several, at a low table, were sucking at sponges in basins of some red liquid. Two couples were preening one another's glistening black bodies. One, in a corner, was mysteriously busy with a complex-looking board vaguely like an abacus. A few were polishing battle-axes and thick, red guns.

"No hope for silence, now," Lanning breathed to Schorn. "We'll take 'em with all we've got!"

He was working with the bone key at the lock. Issac Enders and Courtney-Pharr, beyond him, were setting up the Maxim on its tripod, the muzzle peering through the bars. The lock snapped silently. He nodded to Schorn, and began to swing the door slowly open.

The compound eyes of the farther ant glittered as they moved, and the black claws froze on the abacus. An electric silence crackled in the guard room.

"Now!" Lanning shouted.

"*Allons!*" echoed little Jean Querard. "With you, *mon capitaine!*"

The Maxim thundered suddenly, filling the room with blue smoke and whining, ricocheting lead. Lanning flung Querard and Barry Halloran diagonally across the room, to stop the other entrance.

The great ants retained a hymenopterous vitality. Even when riddled with bullets they did not immediately die. Under the Maxim's deadly hail, they abandoned their occupations, seized weapons, and came charging in two groups at the entrance.

Courtney-Pharr slammed the prison gate to protect Enders and his weapon, defending the lock with his bayonet. And the monsters in front of the Maxim began at last to slump and topple.

The defense of the other door, however, was less successful. Lanning and his companions met the charging creatures with tossed grenades and a blaze of rifle fire. Out of seven, two were blown to fragments by the bombs, and one more crippled. Four of them came on, with axes swinging, to meet the bayonets. The cripple fell back, to load and fire his clumsy gun. It coughed once, and then a burst from the machine gun dropped the ant.

But little Jean Querard was staggering forward, with blood spurting from his breast. Knees trembling, he held himself upright for a moment, propped his rifle so that a charging ant impaled itself on the bayonet. Loud and clear his voice rang out: "*Allons! Jonbar!*"

He slipped down quietly to lie beside the dying insect.

Lanning checked one of the ants with three quick shots to its head, ripped open its armored thorax with a lunge that flung it back, helpless. Schorn stopped another. But the third caught the barrel of Halloran's gun a ringing blow with its axe, leapt on top of him, and clawed its way past.

Lanning snapped another charge of ammunition into his Mauser, and fired after it. But it dropped forward and scuttled out of sight, at a six-limbed, atavistic run.

Barry Halloran staggered back to his feet, his shirt torn off and blood dripping from a long red mark across his breast and shoulder, where a mandible had raked him.

"Sorry, Denny!" he gasped. "I tried to hold the line!"

"That's all right, guy," panted Lanning, running back to open the door again for Pharr and Enders with their guns.

But already, somewhere ahead, a great alarm gong was throbbing out a deep and brazen-throated warning that moaned and sighed and shuddered through all the long halls of Sorainya's citadel.

XI.

THE FIVE survivors of the raiding party, Pharr and Enders, Halloran and Schorn and Lanning, running with their burden of weapons, came up a long winding flight of steps, and through a small door, into the end of Sorainya's ceremonial hall, where the warning gong was booming.

It was the largest room that Lanning had ever seen. Great square pillars of black soared up against the red metal walls, and between them stood colossal statues in yellow gold—no doubt Sorainya's warlike ancestors, for all were armed and armored.

The reflected light, poured down from the lofty crimson vault, had a redness that gave the air almost the quality of blood. Most of the floor was bare. Far toward the other end stood a tall pillar of shimmering splendor—the diamond throne that once Sorainya had offered Lanning. As treacherously, perhaps, as she had also offered it to Wil McLan.

From a chain, beside the throne, hung the alarm gong—a forty-foot disk of scarlet metal. Tiny in that great hall, two of the warrior ants were furiously beating its moaning curve. And a little army of them—thirty, Lanning estimated—came rushing down the hall.

"Quick!" he rapped. "The Maxim!"

He helped set up the hot machine gun, gasping to Schorn, "We've got to get through—and back! The door to Sorainya's own apartments is behind the throne. The strong room is reached through a trap door, beside her bed—quick! The bombs!"

"Devils!" Isaac Enders' lean face was a hard, bitter mask as he started an ammunition belt into the Maxim,

dropped down behind it. "They won't forget you, Israel!"

The gun jettied flame, sweeping the line of ants. Beside him, Pharr and Barry Halloran blazed away with rifles. Lanning and Schorn dumped hampers of hand grenades on the floor, and stooped over them, snapping out the safety pins and hurling them into the rank of ants.

The ants fired a volley, as they came. The thick, crimson guns were single-shot weapons, of heavy calibre but limited range. Most of the bullets went wide, spattering on the metal wall. But one struck Enders, drilling a great black hole in his forehead.

He lurched upright, behind the Maxim. His long, gaunt arms spread wide. A curious expression of shocked, incredulous eagerness lit his stern face for an instant, until it was drowned in a gush of blood. His voice pealed out, in a joyous ringing shout—"Israel!"

He slid forward, and lay shuddering across the gun.

Courtney-Pharr tossed his body away, and resumed the fire.

It took the ants a long while to come down the hall. Or time, measured only by the sequence of events, seemed curiously extended. Lanning had space to snatch a breath of this clean air, so refreshing after the stench of the prison. He wondered how, without key or combination, they could break open the strong room—if they won to its door. And how soon, after this alarm, Sorainya herself might return from the temple, with more of her *kothrin*, to block the retreat.

A FEW of the ants, riddled with lead from rifles and Maxim, had time to slump and fall. A few more, running heedless over the tossed grenades, were hurled mangled into the air. But most of them came on, converging toward the door, chubbing crimson guns, spinning yellow battle-axes.

The four men waited in a line across the doorway, the Maxim beating its deadly roll. Schorn flung his last grenade when the black rank was a dozen yards away and snatched his bayonet to meet the charge. Saving two of his bombs, Lanning leveled his rifle to guard the machine gun, sent bullets probing to seek some vital organ.

Three of the foremost monsters slumped and fell. But the rest flowed over them in a tide of death. Diabolic monsters, fantastic in black, great eyes glittering redly evil in the bloody light, golden axes singing.

Lanning's Mauser snapped, empty. He lunged, with the bayonet, ripped open one armored thorax. But the golden blade of another monster rang against the rifle, tore it from his numbed fingers. The club of a scarlet gun, at the same instant, struck his shoulder with a sledge of paralyzing agony, hurled him backward against the metal wall.

One arm was tingling, nerveless. He groped with his left hand for the Luger at his belt, surged to his knees, sent lead tearing upward through armored, acid-reeking bodies.

Savage mandibles seized and tore away the rifle of Emil Schorn, and the bull-like Prussian went down beneath the rush of two giant ants. They leapt on top of the drumming Maxim. Great black jaws seized the bare, blond head of Courtney-Pharr.

The gun abruptly ceased to fire, and in the breathless scrap of silence the crushing of his skull made an odd, sickening little sound.

"Fight 'em!" Barry Halloran was singing out. "Fight 'em!"

Furiously, with his bayonet, the big red-headed tackle fell upon the two monsters sprawled over the silent machine gun and the Briton's decapitated body.

The Luger was empty again. Lanning dropped it, groped for his rifle on the floor, and surged up to meet the second rank of ants. If he could hold them

for a moment, give Barry a chance to recover the Maxim——

The weird, mute giants pressed down on him. But his arm had come to life again. And he had learned a deadly technique: a lunge that ripped the black thorax upward, then a deep, twisting thrust, to right and left, that tore vital organs.

Yellow axes were hissing at him. But jet-armored monsters were piled before the doorway, now, in a sort of barricade. And the floor was slippery with reeking life-fluids, so that strange claws slid and scratched for balance. Lanning evaded the blows—lunged, and lunged again.

Behind him, Barry had finished one monster with the bayonet. But his blade snapped off in the armor of the other. He snatched out his Luger, pumped lead into the black body. But it sprang upon him, clubbed him down with the flat of a golden axe, sprawled inert on top of his body.

Alone against the ants, Lanning thrust and ripped and parried. He laid one monster on top of the barricade, and another, and a third. Then his own foot slipped in the slime. Great mandibles gripped the wavering bayonet, twisted and snapped it off.

He tried to club the gun. But black claws ripped it from his hands. Three great ants leapt upon him, bore him down. His own gun crashed against his head. He slipped to the floor, beneath the ants, sobbing, "Lethonee! I tried ——"

The *kothrin* were clambering over the barrier of dead. Heedless claws scratched him. He fought for strength to rise, fight again. But his numbed body would not respond. Jonbar still was doomed. And, for him, would it be Sorainya's dungeons?

THE LOUD TATTOO of the Maxim was a wholly incredible sound. Lanning in his daze thought at first it must be a dream. But the reeking body

of a great ant slipped down across him. He twisted his head with a savage effort and saw Emil Schorn.

The big Prussian had once gone down, beneath the ants. His bull-like body was nearly naked, shredded, red with dripping blood. But he was on his feet again, swaying, his blue eyes flaming with a terrible light.

"Heil, Jonbar!" he was roaring. "Ach, Thor! Der tag of Valhalla!"

He started the last belt into the Maxim, and came forward again, holding it in his arms, firing it like a rifle—a terrific feat, even for such a giant as he.

The remaining ants came leaping at him, and he met them with a hail of death. One by one, they slumped and fell. A great, golden axe was hurled across the barricade. Its blade cut deep into his naked breast, and fell. And a flood of foaming red rushed out.

But still the German stood upright, leaning against the shattering recoil of the gun, sweeping it back and forth. At last it was empty, and he dropped it from seared hands. Wide and fixed, his blue eyes watched the last ant stagger and fall.

"Jonbar!" his deep voice rumbled. "*Uber alles! Ja——*"

Like a red and massive pillar falling, he toppled down beside the red-hot Maxim. For a little space there was a strange hushed silence in the Cyclopean crimson hall of Sorainya's citadel, disturbed only by the faint sorrowful reverberation that still throbbed from the mighty gong. And the golden colossi, in their panoplies of war, looked grimly down upon the peace that follows death.

A little life, however, was coming back into Lanning's battered body. He twisted, and began to push at the great ant that had fallen across his legs. A sudden throbbing eagerness lent him strength. For Schorn had opened the way to the strong room. There might

still be time, before the alarm blocked escape——

But Barry Halloran was the first on his feet. Lanning had supposed him dead beneath the ant that brought him down. But he heard an incoherent, muffled shout—"Fight 'em! Fight! Hold that line!" It changed. "Eh! Where——? Denny! Oh, Denny, can you hear me?"

"Barry!"

The big tackle came stalking toward him, through the dead, his naked torso crimson almost as Schorn's. He dragged the dead ant from Lanning's legs, and Lanning sat up, clenching his teeth against the pain in his head. A flood of dizzy blackness came over him, and the next he knew Halloran was pressing Courtney-Pharr's silver flask to his lips. He gulped the searing brandy.

"Make it, Denny?"

Lanning stood up, reeling. A great anvil of agony rang at the back of his head. His vision blurred. The long red hall spun and tilted, and the golden colossi were marching down it, to defend Sorainya's diamond throne.

"Le's go," his voice came fuzzy and thick. "Mus' get that thing. Get back to the ship. Before Sorainya comes! First, the two grenades—key to the strong room."

BARRY HALLORAN found the two bombs he had saved, and then started to pick up the hot weight of the Maxim. But Lanning told him that the ammunition was gone. He snatched up a rifle, and seized Lanning's arm. They started, at a weary, stumbling run, down the colossal red-lit hall.

Lanning staggered, at first, and only Barry's grasp kept him from falling. But his vision cleared slowly, and the pain began to ebb from his head.

It was an interminable way, past the frowning yellow giants and the soaring pillars of black, down to the lofty diamond splendor of Sorainya's throne. But

they ran at last beneath the undying sigh of the mighty gong, and passed the throne.

Beyond was a great arched doorway, curtained with black. They pushed through the heavy drapes, and came into the queen's private chambers. Lanning did not pause to catalog the splendor of that vista of vast connecting rooms. But he saw the shimmer of immense crystal mirrors; the gleam of delicate statuary, ivory and gold; the glitter of immense jeweled caskets; the silken luxury of great couches and divans.

Sorainya's bed, hewn from a colossal block of sapphire crystal, and canopied with jewel-sewn silk, shone like a second throne at the end of that vista of barbaric magnificence. Lanning and Halloran ran panting toward it, trailing drops of blood across shimmering inlaid floors.

Lanning ripped back a wide, deep-piled rug beside the bed. In the floor he found the fine dark line that marked the edge of a well-fitted door, and, in the center of that, a smaller square.

Barry Halloran used his bayonet to pry out the central block, while Lanning unscrewed the detonator cylinders from the two bombs. Beneath the block was revealed a long keyhole. Lanning poured the two ounces of high explosive from each grenade into the little square depression, let it run down into the lock. He thrust one detonator into the keyhole, with the safety fuse projecting. Barry came dragging a great jeweled coffer of red metal from the foot of the bed, reckless of the scarred floor, pushed it over the lock to hold in the force of the charge. Lanning took the rifle, put a bullet into the percussion cap. They stepped quickly behind the bed.

The floor quivered to the shattering blast. Glittering fragments of the burst coffer rocketed to the lofty ceiling. Jewels, exquisite toilet articles and shattered jars of cosmetic, scraps of silk and fur fell in a rain of splendor.

They ran back around the sapphire bed. A blackened hole yawned in the floor. A tough sheet of red metal had burst jaggedly upward. Lanning reached his arm through to manipulate hot bolts and tumblers.

The square section of the floor dropped suddenly, elevatorlike. Halloran, after a startled instant, stepped upon it with Lanning. And they were lowered swiftly into the strong room.

IT WAS A vast space, square and windowless. The concealed lights which sprang on, as they descended, burned on hoarded treasure. Great shimmering stacks of silver and gold ingots, mysterious piled coffers, great slabs of unworked synthetic crystal, sapphire, emerald, ruby, and diamond. Statuary, paintings, strange mechanisms and instruments, tapestries, books and manuscript—all the precious relics of the past. And, most curious of all, a long row of tall crystal blocks, in which, like flies in amber, were embedded oddly lifelike human forms—the armored originals of the golden colossi above. This was not only the treasury but the mausoleum of Sorainya's dynasty.

"Ye gods!" murmured Barry Halloran, blinking, forgetful of his wounds. "The old girl is one collector! This junk is worth—worth more money than there is! King Midas would turn green!"

Lanning's jaw went white.

"I saw her once—collecting!" he muttered bitterly. "She slaughtered a whole village, because the people couldn't pay their taxes—when she had all this!"

The dropping platform touched the floor.

"We're looking for a little black brick," Lanning said swiftly. "They covered the thing with a black cement, to hide it from the *chronoscope*." Shuddering to a little helpless, trapped feeling, he looked back up at the square door. "And hurry! We've been a long

time, and that gong would wake the dead. Sorainya'll be here, soon."

"Sure thing!" muttered Halloran. "It's a long way back, through that prison and down the cliff to the ship."

They began a frantic search for the small black brick, breaking open coffers of jewels, and shaking out chests of silks and furs. It was Barry Halloran who found the little ebon rectangle, tossed carelessly into the litter of a cracked pottery jar that had seemed to serve as a waste basket.

"That's it!" Lanning gasped. "Let's get out!"

They leapt back upon the platform. Lanning tapped a button on the floor beside it, and it lifted silently. His red hands trembling with a wondering awe, Halloran handed the heavy little brick to Lanning.

"What could it be?" he whispered. "So small and yet so important!"

Lanning looked down at the glazed black surface that hid the object stolen from the past: the object whose position meant life or death to Gyronchi and Jonbar. He shook his battered head.

"I don't know—but listen!"

For their heads had risen again into the queen's bedchamber, and he heard far-off a monstrous brazen clang like the closing valves of a metal gate, the

far tinkle of weapons, and the clear, tiny peal of a woman's anger-heightened voice. His strength went out, and cold dread ached in every bone.

"Sorainya!" he sobbed. "She's coming back!"

They scrambled up to the floor, without waiting for the rising platform to come level, and ran desperately through the empty glitter of the vast apartments of the queen, back the way they had come.

They passed the black hangings. Once more they came into the lofty, red-lit immensity of the ceremonial hall, where the golden colossi still towered, frowning, between the columns of black. Again they ran beneath the whispering gong, beside the high diamond throne. And there, under the moaning disk, they halted in cold despair.

For a black horde of the *kothrin*, gigantic four-armed figures tiny in the distance, were pouring into the hall. Running gracefully ahead to lead them, flashing in her red-mailed splendor, came the warrior queen.

Lanning turned to look at Barry's crimson stricken face, and read the desperate question there. Warily, he shook his head.

"She's cut us off!" he groaned. "There's no way out——"

TO BE CONCLUDED.



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THE GREAT EYE

by

R. DeWitt Miller

A science article discussing the aims and limitations of the 200" Mt. Palomar telescope

MAN may be defined as a two-legged animal surrounded by question marks. The advance of science, and therefore of civilization, has resulted from the progressive showing back of those question marks. Inside the question marks man may rationally govern his fate.

The recession of the question marks is not steady. Every once in a while science makes a "big push" and gains a lot of ground. At the present time scientists at Mt. Palomar, California, are making ready for what may be the biggest push of this century.

Some three to six years from now the dome of an observatory will slide back and man will push back those question marks by 400,000,000 light-years. The gigantic 200-inch reflecting telescope, now being ground at the California Institute of Technology, will penetrate at least four times farther into space than any instrument ever constructed on the Earth.

In fact, the 200-inch telescope represents the highest technical achievement of human science. Twenty years of research and over a decade of the most painstakingly accurate construction ever attempted will have gone into its building. The human race has thumbed its nose at its natural limitations and made a supreme effort to see, not what is beyond the next hill, but what is beyond the misty patch of the farthest nebula—and yet even that is not as important

as *one* good photograph of a minor heavenly body some 34,000,000 miles away, which is the ruby color of blood. But let's get in a little groundwork before we discuss the possibilities of obtaining an answer to that greatest question mark.

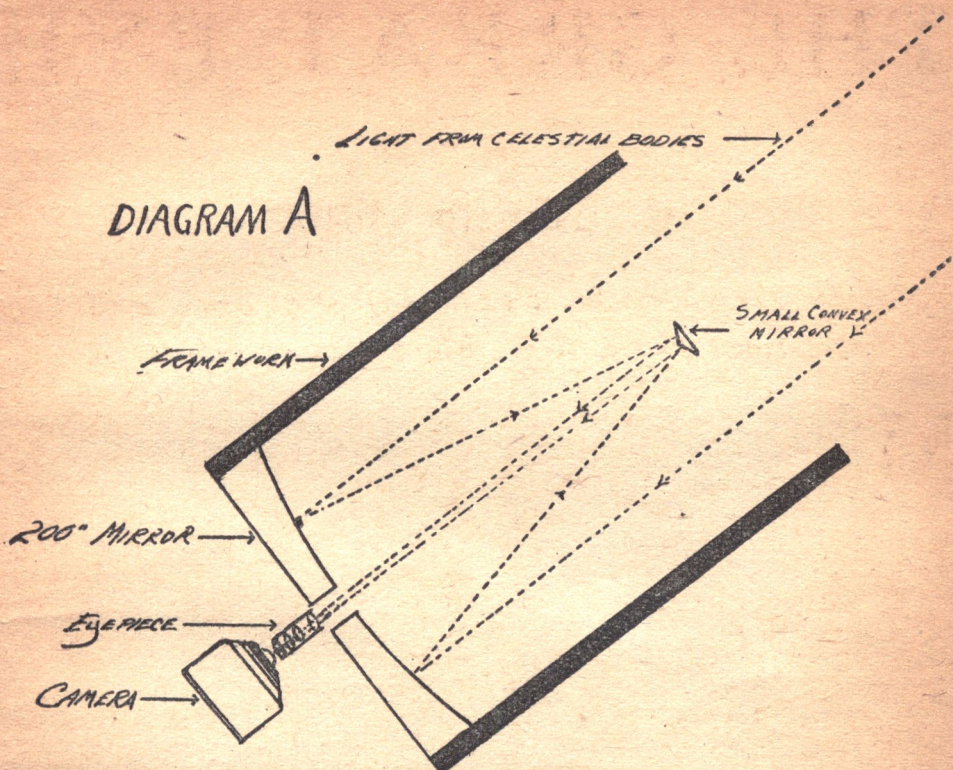
The Mt. Palomar telescope is of the reflecting rather than the refracting type—a huge mirror, ground to a parabolic curve, is used to collect many times the light which can enter the unaided human eye and to focus it at a single point. A parabolic curve is used because it will bring parallel rays of light to a sharp focus. The grinding of this tricky parabola is one of the most difficult problems in the construction of the Mt. Palomar reflector.

After the light has been focused by the mirror, the image is magnified by the eyepiece. An eyepiece of a reflecting telescope functions exactly as does a microscope. In other words, it magnifies the image produced by the mirror.

There is a theoretical limit to this magnification. Due to the unavoidable residue of error left after the most painstaking work and to technicalities of optics, the maximum possible magnification of the eyepiece is about 100 diameters per inch of the diameter of the mirror. In practice, however, the theoretical limit isn't even approximated, as will be seen.

The 200-inch telescope would then have a *theoretical* limit of 20,000 diam-

DIAGRAM A



One of the possible optical-system set-ups for the 200" Mt. Palomar telescope. This one explains the presence of the hole in the center of the huge mirror. Since the lesser mirrors, lenses, etc. are comparatively easy and cheap to make, several complete systems of auxiliary apparatus will be provided. The small convex mirror may be replaced by a diagonal mirror which throws the image to one side of the tube, out through the hollow axis of the supporting members (not shown above) and thence through a train of optical apparatus to an immobile, massive, and hence highly accurate spectrometer in a room below. Or camera and observing equipment may be mounted in place of the small convex mirror and used directly. The Great Eye itself may be used to supply gathered radiation to hundreds of different set-ups in dozens of different ways.

eters. Could such theoretical power be employed, the Moon would be brought within an apparent distance of twelve miles of the Earth. As the mountain ranges, cones, and craters on the Moon's surface vary in elevation almost that distance, some idea of the terrific magnification theoretically possible on the 200-inch reflector can be seen.

For instance, Venus, at its closest to

the Earth, would be brought within an apparent distance of 1300 miles. A person unfamiliar with astronomical observations, basing his opinion on terrestrial experience, may well ask: "What can you see at 1300 miles?"

To give a correct answer to such a question, two factors must be borne in mind: first, the relative size of terrestrial and astronomical objects, and sec-

ond, the limitation imposed on vision by the atmospheric conditions prevailing on Earth.

The mightiest thing on this planet is probably the Himalaya mountains, capped by the icy crest of Mt. Everest. Yet the height of Everest is less than one seven-hundredth the diameter of the Moon. Astronomers are looking at planets and stars, not trying to see the girl in the next apartment house.

EVEN SO, no one knows the potentialities of the human eye. After all, no man's eye, naked or aided by a complex system of lens and mirror, has ever escaped the dead weight of atmospheric interference. We live in an eternal fog—in fact, we are able to live only because of that fog. But the fog forever bars the human eye from using to the maximum its abilities to see *beyond*.

Sometimes, however, hints are given of what might be expected should that atmospheric blanket be escaped. Trained observers at the Mount Wilson Observatory—which houses the 100-inch Hooker telescope—can see the *flag pole* on top of a hotel in the town of Santa Monica. This is a distance of twenty-five miles. Of course, such moments of relatively perfect vision are fleeting, lasting at most a few minutes on two or three days in a year. But they are a glimpse of what we could expect if we could, in some way, completely escape atmospheric distortion and haze.

But such an escape is impossible (?)—remember that question mark a few minutes. The giant eye now being constructed for Mt. Palomar can no more escape the atmospheric conditions existing at that point on the surface of the Earth, than could an ancient Indian's eyes, staring in wonder at the stars.

But all science is a struggle within limits. Let us see what possibilities we may reasonably hope for. How far will the 200-inch telescope push back the question marks?

Experience with the 100-inch telescope at Mount Wilson—now the largest in existence—shows that the maximum magnification under good atmospheric conditions is 1200 diameters. Of course, there are so-called *perfect* nights when the conditions allow far greater power. But such nights exist, at the most, only two or three times a year, and are completely unpredictable. No adequate reason why the atmospheric haze should suddenly clear for a few minutes has ever been given. Besides, when a perfect night does come, the telescope is likely to be in use on some specialized piece of work which does not require great magnification.

It must be borne in mind that high eyepiece magnification is used only on objects in the solar system, comets, and some of the nebulae. Most of the celestial objects far out in space show only as points of light, and magnification, no matter how great, is a disadvantage, as it cuts down the field. Magnifying eyepieces are used only where surface detail of the object is of advantage.

The conditions at Mt. Palomar are better suited to observation than those at Mt. Wilson. The atmosphere above this point is generally clear, and free from sudden storms. This last point is of great importance, as much of the atmospheric interference is due to air currents rather than to dust. Moving masses of air of different density and temperature cause hopeless image distortion.

Besides the more suitable weather conditions, Mt. Palomar has a second important advantage. Its location in a desert area insures freedom from Earth illumination due to advancing civilization. At Mt. Wilson this has become a serious problem. The mushroom growth of the near-by cities of Los Angeles, Long Beach, Pasadena, etc., together with the ever increasing use of electric illumination, makes high power observations often next to impossible.

Giving conditions at Mt. Palomar every possible advantage, it is still unlikely that observers will be able to go above 2500 diameters—except perhaps on freak perfect nights.

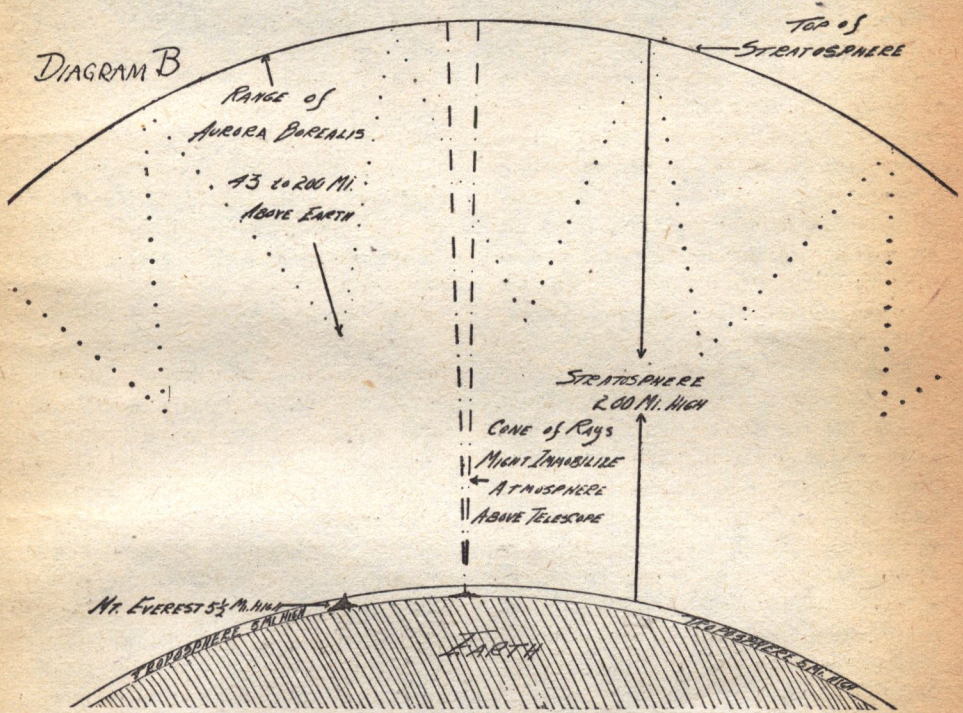
ON THE FACE of it, this data would seem to indicate that the building of the 200-inch telescope was a waste of perfectly good Pyrex glass. However, such an assertion leaves out the second important item in telescopic observation—brilliancy.

As the 200-inch reflector collects four times as much light as the 100-inch mir-

ror, the brilliancy of the image will be quadrupled. The range into space of the new mirror will be proportionately increased, though the size of the image may not be increased. Adding to this the increase in brilliance due to the superior method of silvering used on the 200-inch mirror, we discover a great advance in the brilliancy half of the question.

Increase in brilliancy has four distinct advantages:

1. It allows the probing of greater depths of space. (As stars and more distant nebulae do not show a disk and



Nothing Man makes is perfect, but telescopes come far nearer perfection than does the atmosphere through which we must observe. To the astronomer, our atmosphere is as great a hindrance as a pane of cheap window-glass is to an ordinary terrestrial telescope. The difficulty is that air moves; it waves, wiggles and crawls, and every motion of the air changes its refraction and moves the image about on the photographic plate. If some cone of rays—some as-yet-unknown force—can be discovered which will immobilize that air, it will mean more to astronomers than would a 2000" telescope.

surface details as do the planets, great magnification is not necessary.)

2. It allows photographs to be made in shorter time. This permits more varied observations in a given period of time, as the telescope is not tied up so long on a single exposure.

3. It permits better observation of the surface details of the planets, which, although they may be no larger, will have greater brilliancy.

4. It will give better photographs by infra-red light. (The significance of this point will be discussed later.)

All the above points are dependent upon the aid of photography. In fact, astronomy is more and more becoming a sort of super-camera club. Whereas visual observations are always open to argument, a photographic plate gives continually-existent evidence. The use of time exposures, sometimes extending over several nights, enables the sensitive emulsion to pick up traces of light far too faint for the human eye. A photographic plate is cumulative, adding up weak impressions, where the eye cannot.

A grainless photographic plate would do as much for astronomy as the 200-inch telescope. Such a plate would allow a degree of enlargement far beyond anything possible at the present time. But so long as all available types of plates form grain—i. e., the clumping of the individual crystals of silver—the degree of enlargement is strictly limited. Beyond a certain point, the enlarged image becomes only a mass of meaningless silver grains, all of the original detail being lost.

It is possible, of course, that the present craze for miniature cameras may stimulate the development of such a grainless film. That research set in motion by the host of wild-eyed shutter-clickers may some day solve the mystery of the planets is an off-chance, more amusing than likely.

The fact remains, however, that modern photography has provided the only

feasible way to escape partially the bug-bear of atmospheric interference—that is, through the use of infra-red light.

Anyone who has ever photographed by infra-red light knows that these long waves will penetrate haze. This same principle has been applied to astronomical photography to counteract not only Earth haze, but also that which surrounds many of the planets. Although infra-red photographs give a somewhat distorted picture of the subject, they are at present the most successful means of escaping the atmosphere which must encircle any world habited by life as we know it.

Out of this maze of buts and ifs, what definite hope of answers to the thousand questions in the sky can the 200-inch telescope hold?

WE KNOW certainly that it will probe deeper into space. It is even possible that this will result in finding a definite end to our universe, a distance beyond which there is nothing but starless, empty space. Such a discovery would indicate that our universe was, after all, finite—and yet there is always the disturbing thought that an even larger mirror would again open new vistas.

New light will undoubtedly be thrown on the moot question of the "exploding universe" and the shift to the red in the spectrum of the farthest nebulae. Stated simply, this theory maintains that the spectral analysis of nebulae deepest in space shows that they are traveling away from the center of the universe at ever increasing speed.

This theory is, to a certain degree, contradicted by Einstein's contention that space, or rather "space-time," is curved, and hence limited. But in any case, the light most needed on this matter will come from better human comprehension of the abstract, rather than from a telescopic mirror—no matter how big. Searching the borders of space al-

ways turns out to be searching the borders of the mind, and astronomy of the depths of ultimate space inevitably ends up as theoretical mathematics. But the new reflector will at least hold the mathematicians somewhere near reality by giving them a check for some of their conclusions.

In any case, the probing of a *lifeless* universe becomes a rather futile chasing of tails. The most intriguing reason for peering into telescopes must be the eternal hope that sometime, somewhere, man will find evidence that his world is not the only spot where life and consciousness exist.

As no telescope conceivable today will ever settle the question of possible life outside the limits of the solar system, the matter comes down to a question of what the 200-inch Palomar telescope will show of the surfaces of those planets which travel with us through the unknown, eternally circling that dwarf star, our Sun.

Eliminating the planets on which conditions of temperature, etc., make life impossible except in some form probably unrecognizable to human eyes, there remain three astronomical bodies where it may still be hoped to discover traces of present, or past, life.

First of these is our sister world, the Moon. Although it has been generally accepted that the Moon is a lifeless, airless world, there are still faint echoes of doubt—and new advances in sciences usually begin from such faint voices.

Several times during the last fifty years, independent observers have claimed to have seen variations in color and shape of small areas of the Moon's surface. William H. Pickering, one of the best known American astronomers, stated in August, 1937, that "there are reasons for believing there is life on the Moon." He based his conclusions on color changes occurring in regular monthly cycles.

Admitting that the Moon has no ob-

servable atmosphere at the present time, it is still possible that faint traces of oxygen or other unstable gases still lurk in the deep caverns, which probably underlie the surface. Such gases might at least support an adaptable form of plant life.

In any case, there is good reason to believe that the Moon once had an atmosphere. If so, life may have developed, and left its mark. It is not inconceivable that such life, faced by the death of its world, would make a terrific final effort to escape its doom, an effort which might leave some indelible trace on the surface of the Moon.

With the largest telescopes in use today we can see a marking on the Moon's surface less than a mile in diameter. But with the 200-inch telescope, and the superior observing conditions at Mt. Palomar, buildings the size of the larger Egyptian pyramids should be visible.

WE HAVE every reason to hope that the 200-inch reflector—if used for that purpose—will either reveal traces of life, past or present, on the Moon, or reduce the chances of finding such traces to a dismissible minimum. But no telescope, though it have a mirror a hundred miles in diameter, will ever reveal that cosmic hideout, the dark side of our satellite. If any remnants of life and civilization have escaped to the eternal darkness on the far side of the Moon, no observer on Earth will ever see it.

So let's leave the final arguments for the case of life sometime on the Moon, until the great mirror is finally in place, and turn the lens of speculation on the planet named for the goddess of love—Venus.

Here, however, we can have little hope. The surface of Venus is forever hidden by impenetrable clouds which make her so bright an object in the evening sky. No matter how close you bring a cloud bank, and no matter how brilliant you make it, it is still a cloud

bank. The only possible method of seeing the surface of this world is through the perfection of infra-red photography. The new telescope will play its part in such work, but without the aid of the infra-red rays it is powerless—and it would take plates far more sensitive than any we have today to pierce the eternal Venusian clouds.

So, inevitably, we come to that crimson question mark, the Red Planet. After the tumult and shouting have died, and the astronomers have taken their mirrors and their arguments and departed, Mars remains the most important thing in the sky. If life has marked the face of another planet besides Earth, Mars remains the most likely place for a telescope to discover it. This planet is not surrounded by the never ending clouds which protect the secrets of Venus.

Certainly Schiaparelli saw something resembling a tracework of fine lines on the surface of Mars in 1877. These observations were corroborated by A. E. Douglas and Dr. Percival Lowell. Conclusive proof of the existence of the canals has been piling up during recent years, culminating in the findings of Dr. E. C. Slipper, who photographed the Red Planet during the early months of 1937.

However, the multiplicity of the observations have given only a confusing multiplicity of findings as to the finer parts of the markings. That many astronomers have fled in timid fear from such a hot debate does not mean that we need less debate, but braver astronomers.

Here, at least, we can feel confident that the 200-inch telescope will make astronomical history. Although Earthly atmospheric conditions will be no better for observation of Mars than any other heavenly body, it is reasonable that there will be some increase in possible magnification. Perhaps the number of diameters now possible at Mt. Wilson will

be doubled. But in any case, the image will be intensified, and advanced photographic equipment will produce pictures which will settle at least the general system of the mysterious canal network, or their non-existence.

That is the least we can expect. Infra-red work will probably clarify the question of the existence of a reasonably dense atmosphere. More sensitive temperature readings will certainly give a better estimate of the temperature of the Martian landscape, and of the seasonal changes.*

FINALLY, there is always the chance that some one will have the giant mirror trained on Mars on one of those strange *perfect* nights, and that such a night will occur at a time when the orbit of Mars brings it closest to Earth. Then let the astronomers turn on the power, not the full theoretical power, of course, but enough to get just *one* detailed photograph of the surface of the Red Planet. That one picture would be worth the several-million-dollar cost of the 200-inch reflector.

But is the 200-inch mirror the ultimate in telescopes? Is there an absolute limit to the depths which man can peer into the sky? Yes—and no. At the time plans were made for the Mt. Palomar mirror, scientists considered building a 300-inch one instead. They finally decided on the 200-inch size, because of the technical questions of transportation of the disk. But had there

* Infra-red photography has another use, that of "level-sampling". Since infra-red light has greater penetrative powers where haze, dust, and clouds intrude, and the penetrative powers progressively decrease with decreasing wave length—i.e., increasing blueness of the light—samplings of the various layers of another planet's atmosphere can be made. Thus, if a series of photographs is made, the first in the extreme infra-red, the next in near infra-red, then red, orange, green, blue, violet, and finally ultraviolet, the first might show the surface of the planet, the second give traces of atmosphere, and progressively more atmosphere effect, till the final picture was representative not of the planet's surface, but of the surface of the atmosphere. Recently, a dust storm on the surface of Mars was revealed by this level-sampling method. Ed.

been much to gain, that extra 100 inches would have been added.

The truth is that, although the size of telescope mirrors is limited only by an ever increasing technical problem, there is a very definite limit imposed by atmospheric interference. If only man could escape that eternal haze that forever prevents his answering the riddles of space! But why speculate? This is not a fairy tale. And yet—

There is one man who is willing to speculate. He is Dr. John Anderson, head of the Astro-Physics Department of the California Institute of Technology. At present he is one of the guiding brains in the building of the 200-inch mirror.

"There is one conceivable way of escaping the atmospheric haze," he says. "That is to immobilize the air above the telescope. At Mt. Palomar we are high enough to escape most of the interference due to dust and water vapor. On good nights our principal problem is with shifting air currents of different densities. This interference may extend as high as the top edge of the stratosphere, two hundred miles up.

"I recently conducted an experiment in stopping atmospheric agitation above a given point on the Earth's surface. I sent up a cone of radiation. If this radiation had stopped the atmospheric movement, it would have been simple

to have directed a telescope inside the cone.

"Unfortunately, the experiment was not a success. Sometime I may try again. Other men will try. Eventually, some one may find a technique that will work. Perhaps some suggestion will come from another field of science.

"The 200-inch telescope will undoubtedly greatly increase our knowledge of the skies—how much we won't know until it is actually in use. But the greatest problem—at least so far as the planets are concerned—still remains, that of atmospheric interference.

"My cone of rays didn't work. But when science is ready for a new discovery, that discovery usually comes—often from the most unlikely place. Science teaches one not to say what *cannot* be done. Those of us alive today may yet escape all atmospheric interference and see clearly into the sky—and when that day comes, no man may say what we may find."

Those paragraphs are only speculation today. But they are the speculations of a man who has spent his life seeking to answer the thousand questions of the universe beyond our little planet. Of course, if you prefer, you can say that such dreams have little to do with science. They are like the rest of those idle speculations—without which we would still be hiding in caves and killing animals with wooden spears.



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PHILOSOPHERS

WELL, I'm blown!" Dismay burst from the heat-parched lips of Voorland as he scrambled to his feet from where he had been lying, half-stunned, on the sur-

face of a stranger world than he had thought could ever exist.

Voorland was hatless, coatless. Perspiration dampened his bedraggled shirt and caused it to adhere uncomfortably



Behind, the magnets, motors and cables trailed, each borne along on proportionately stout legs of protoplasm growing up from the ground.

D. L. JAMES

Tells of a living planet ruled by—

OF STONE

to his stalwart shoulders. He looked very much as if he had but recently stepped from his laboratory. He had.

For a moment he stared at the tumbled wreckage of his pet invention—a

machine that, by dissolving the ether, had made his journey hither as simple as stepping through a doorway. Now at a critical time, just as he was attempting to leave this nightmare world,

it had failed him. The door in space had closed, leaving him on the wrong side.

"Ye gods!" he muttered. "Mac was right. I shouldn't have taken such a chance. But, even at that, I'm lucky—lucky one of those babes didn't fall on me!"

Those six huge magnets—each of them weighing a ton—together with other parts of his unique machine, lay scattered around him. He was stranded, without provisions of either food or water. But being a physicist of exceptional devotion, this calamity failed to shock him as might reasonably be expected.

Breathing deeply, he wiped the perspiration from his brow. That swollen, blue-white sun still blazed down scorchingly from its setting in the greenish bowl of the sky. His gaze leveled out over that illimitable sweep of surrounding hillocks. Bare and silent as he had first observed them, but appearing even more desolate.

Three furtive strides brought him to the big motor. The disc and quartz-cored coils of thin glass tubing were still attached. Despite its weight and the distance it had fallen, it was but slightly sunk in the ground—that strange ground which was unlike sand or loam or rock, but was rather a gelatinous, leathery stuff of pallid hue, like the body of a snail.

Voorland examined the motor, running his hand over the raw metal of the severed base. "I'm glad Mac didn't get caught," he muttered. "It's easy to figure out what happened. The force-screen shifted, then the power snapped off. I wonder what became of that confounded stone I was trying to take back as a specimen?"

He peered around. Almost at once he discovered it—a fragment of one of those walking stones.

The thing lay on the ground just outside the conglomeration of fallen ap-

paratus. Or, rather, it was not lying on the ground, but perched up on its pseudo-legs, a few inches above the surface, as if meditating flight.

A chill ran down Voorland's spine. Those legs, he knew, were not attached to the stone, but were merely pseudopodial projections sprouting upward against it from the ground underneath.

This orb—this world on which he was stranded—was, he had reason to believe, far outside the Solar System and probably exterior even to the Galactic System itself. Possibly it was located in some inconceivably remote island universe, where the very texture of space and the prevailing natural laws were of an unknown order.

Indeed, aside from this vague assumption, Voorland knew almost nothing of his surroundings, nor by what strange reversal of nature the very ground on which he stood should appear to be alive.

BUT NOW, as his attention became fixed on this stone—a highly crystalline lump of what was apparently nothing but translucent green beryl—poised there on its pseudo-legs near him, a voice from beyond the brink of audibility seemed to swell into his consciousness.

"You chump! Now you're in a fine fix!"

Not, of course, in exactly those words. That was how Voorland interpreted the idea.

Startled, he gazed at the stone. "Telepathy," he muttered. "Well, I'd already guessed that's how they manage those legs. Mental control. The ground's alive—but the rock crystals do the thinking."

"Sure, why not?" With growing clearness came that psychic voice, as if in answer to his thoughts. "I perceive you are an organism of very low order, formed of matter in the second cycle—matter that can maintain but a transient, synthetic consciousness. That accounts

for your rash attempt to kidnap me. Now it's up to me to present you to the Sigarians, to be studied. I'm afraid you'll find it rather unpleasant. But don't blame me. You brought it on yourself."

Voorland mopped his flushed face with the soggy sleeve of his shirt. His thoughts were now pretty well mixed up. A thinking stone! But he was trying to keep a firm grip on himself, and presently, with a degree of composure, he managed a question, speaking aloud, although he realized this was probably superfluous.

"The Sigarians? Who are they?"

"Organisms somewhat like yourself. Newcomers here only a few years back, occupying no stable position either in space or time, but they get a big kick out of studying living forms. Although if it were left to me I'd wash my hands of you entirely. I lost all interest in such things aeons ago. Now, like my fellows, I much prefer to lie up here in unbroken contemplation, absorbing cosmic energy. But time passes. Come, let's be off."

Green light flashed from the polished facets of the stone, which was as large as Voorland's two fists. Now it took a few tentative steps, circling the tumbled wreckage. Its manner of locomotion was at once unique and horrible. Fresh sprouts, like the arms of an amoeba, appeared with machinelike regularity from the ground underneath, pressed upward against its lower surface and bore it along, to ultimately flow in on themselves, shrink and disappear as soon as they had served their purpose.

And as it moved, the stone left no trail on that leperous white ground. It smoothed off immediately into its customary leathery surface.

Voorland, however, had no intention of leaving the wreckage of his apparatus, for he felt that in those huge magnets, motor and disc, lay his only chance—definitely slight—of ever departing from

this ghastly world into which he was exiled.

"Ah, I see you don't wish to leave this stuff behind," said the voice in his consciousness. "Very well then."

Pseudopodial legs immediately appeared under each of the huge magnets, under the motor and under each separate piece of apparatus. With one accord, they all reared up, stood poised, waiting, ready to march away.

THE EFFECT was decidedly unpleasant. Voorland felt the short hair rise on the back of his neck.

"Look here," he hesitated, speaking aloud, his voice sounding weak and flat in that thin, hot air. "Where are these—Sigarians? Where are we going?"

Immediately a picture formed in his mind. A dark, cavernous inclosure where pin-points of light moved and flickered. He caught a vague impression of huge girders and beams upholding a Gargantuan metal dome. And without knowing how or why he knew, he sensed that this place was somewhere under his feet, somewhere down toward the core of this protoplasmic-sheathed orb.

Then the image faded. Voorland saw that his guide, or captor—the crystalline lump of thinking green beryl—was waiting. And somehow its rigid, unchanging form manifested rising impatience.

"Really, we must be off," it said. "Come along now."

Still Voorland hesitated. His throat felt parched and dry. "Hold on a moment," he muttered under his breath. "Show me one of these Sigarians—these organisms you say are like me."

Swiftly, another image formed on the visual screen back of his eyes. He caught a vivid but momentary impression of a pallid white form, of a head with glassy, staring eyes, and of a complicated arrangement of jointed claws and legs.

Voorland gasped as the image swiftly

erased itself. "Hell! If that's a Sigarian, count me out!"

"Oh, well, then," sighed that inward voice. "I don't like to appear rude and insistent, even in my dealings with an evanescent organism such as you. But if you prefer it that way——"

Suddenly, Voorland was moving entirely against his will down the slope of the hillock at an even and quite rapid rate. He didn't need to glance downward at his feet to know the cause; but when he did look, he barely restrained a cry of revulsion.

Pseudopodial sprouts from that living horror underfoot were upholding him, bearing him onward. The sensation was like standing on a moving escalator floored with rubbery, writhing bristles.

Almost immediately Voorland lost his balance, fell. But his advance continued uninterrupted. Fresh pseudopodia appeared with surprising suddenness, caught his body as he toppled sidewise, carried him along with an inexorable, businesslike efficiency.

Voorland wriggled to his knees and stared spellbound at that weird, moving caravan of which he was a part. Behind him, in single file, marched the six huge magnets, each upheld by a set of thick, straining legs. The even heavier motor, with its attached disc, staggered along in the rear. Broken wires and cables dangled, but did not drag over that pallid surface. Each was now provided with a series of tiny legs throughout its length, wherever it touched the ground, appearing as so many crawling, thousand-legged worms.

And heading that awesome line of pedestrians was the thinking stone, marching along on its own set of pseudolegs in a nonchalant, sangfroid manner, quite as if it were not directing the whole affair, and seemingly inattentive to the incredible retinue trailing along behind.

"The devil!" Voorland struggled to extricate himself from his not-too-dig-

nified position. "This is a heck of a way to travel. Let me up; I'll walk."

SEVERAL TIMES he managed to regain his footing, only to tumble headlong the next instant.

"You may as well cease those foolish exertions," declared the telepathic voice of his captor. "Why don't you try to collect what small reasoning power you have, and admit that you are utterly powerless to avert or alter the fate in store for you—just as all puny, temporary organisms, such as you, must inevitably do in the end? There, that's better. I see you are following my advice."

Voorland had indeed relaxed, not in complete hopelessness, but because he sensed that further struggle at the present moment would be unavailing.

He now saw that their line of march had carried them completely down the slope of the hillock and halfway up the next. They seemed to be moving in the direction of that dark, shadow-filled ravine into which those other thinking stones had scurried when they first became aware of his presence there among them. But now he could discover nothing of that black gash. Presumably, it had closed up like a huge mouth.

"I see you have your thoughts somewhat in order," remarked the beryl crystal, as clearly as though it were not striding along ten yards in advance of Voorland. "But you are still battling with wild plans of escape. I don't mind letting you know that, if it were possible, I might aid you to do so. Despite your attempt to kidnap me, I hold no hard feelings. You are wondering if you cannot make friends with the Sigarians, and get their help in reassembling your apparatus, so that you may return to a place you call 'Earth'—a small, unimportant planet in a different space-time continuum. Very doubtful, I must say.

"You are also playing with the idea that possibly 'Mac' may come to your

rescue. 'Mac,' I perceive, is that other similar organism, a close friend of yours in whom you have confided. However, you doubt 'Mac's' ability even to understand the notes you have left behind, and you realize that before he can possibly duplicate your apparatus, you will, in all likelihood, have ceased to exist as a conscious entity."

A feeling of awe rose in Voorland at this accurate recital of his thoughts.

"You seem to know everything," he admitted. "Tell me, then, what in the devil is this stuff underneath us?"

The stone paused. Voorland's continued motion lessened the distance between them to a bare three yards, then it, too, ceased.

"This 'stuff,' as you call it, is the perfect living substance. It is, in a physical sense, practically immortal. It subsists entirely on raw, inorganic matter—and is only vaguely conscious."

"And you call that perfection?" Voorland was thankful that their march was delayed. One by one, the huge magnets drew near, paused.

"Ah, my friend," came that mental voice, "I see you have trouble in differentiating life and consciousness. They are as far apart as the poles, I assure you. The principle of consciousness, mind, intelligence—call it what you will—rests in the atom itself."

"Heisenberg's Uncertainty Principle, eh?" muttered Voorland. "Something about that you can't predict the behavior of an electron."

"Exactly!" The stone suddenly hunched itself up proudly on its borrowed walking equipment. "And in me, my friend, you see a very fair specimen of the end and aim of life itself—the perfect thinking substance. Life is just a sorting-out process. Matter that has been worked and reworked for a few billion years by living organisms is quite capable of crystallizing into a conscious, intelligent entity—as a single glance at me will prove to you. Now

we've wasted enough time. We shall descend to the buried dwelling of the Sigarians."

"Descend?" Voorland threw uneasy glances here and there.

VOUCHING no reply, the stone started moving. Voorland found himself following after it—still involuntarily—and in another moment that weird procession was again under way.

Looking forward, Voorland saw the ground opening immediately ahead of the walking stone. In another instant they were in a shallow groove, which deepened swiftly as he watched. Following along in single file behind marched that incredible consort of equipage.

Rapidly the groove became a narrow valley, then a deep canyon, whose vertical walls were composed of that leathery, protoplasmic matter which seemed to smother this dread world in its heavy, living folds. But now, at this depth, it had lost something of its leathery appearance, becoming more gelatinous—slimy.

It grew dark. The thin strip of greenish sky overhead narrowed, blotted out. The air became stifling, noisome with a scent of living matter.

The passage slanted steeply downward. On the heels of the withdrawing light, a rising dread of what was before him beat persistently at Voorland. That buried metal dome—what manner of beings were those pallid white things that they could dwell here under such conditions? But he struggled to throw off this oppressive sense of helplessness.

Presently, his eyes adjusting themselves to the enshrouding dimness, he saw that a vague luminescence was emitted by the living walls of the tubelike channel through which they passed. There came the disturbing realization that those walls were oozing together immediately behind his odd convoy.

No further mental impressions came

from the thinking stone, which must have been thoroughly occupied in directing each movement of that extraordinary retinue and in keeping the passageway open.

But Voorland saw that this incredible body through which they were moving was not homogenous, but was honeycombed and grottoed with innumerable air passages and pockets, like a monstrous sponge.

Now, by that emitted phosphorescent light, Voorland saw that they were entering a bubblelike space of huge dimensions. Around him were collected a multitude of thinking entities like his captor, except that they seemed to resemble many different minerals.

Huge, faceted masses of crystal moved sluggishly aside. Here and there among them drooped thick, writhing tentacles of the protoplasmic matter they seemed to control.

Voorland's advance ceased. Now, for a time, something like a conference took place around him. And in a telepathic manner he could sense rising excitement, but no single, clean-cut impression came to him.

At length, however, the green beryl crystal separated itself from the others and drew near Voorland.

"MY FRIEND," came its mental voice, "we are very near the domed dwelling of the Sigarians. I have conferred with my fellows. We know that your desire is to return to your proper sphere, and to do this you must first have opportunity to reconstruct the apparatus that made your entry here possible. You will require many things—things that are obtainable only among a race of beings whose science is somewhat on a level with your own.

"In the buried dwelling of the Sigarians, anchored to the rocky core of this planet, is, we believe, all that you would require. But the Sigarians are difficult creatures to deal with. When first

they migrated here from out of space, we suffered greatly at their hands—many of our numbers were completely disintegrated in their furnaces and acid vats.

"They are extremely difficult to converse with, and it was only after a considerable lapse of time that we established amiable relations with them. This agreement calls for the delivery into their hands of all meteorites and life forms that land here from space. In return for this service our own members are to be held inviolate.

"We regret that this demands your surrender to the Sigarians. Consequently, we have worked out a plan which may save you and at the same time give you opportunity to reconstruct your apparatus.

"I shall now conduct you to the Sigarians, and, from time to time, direct you toward the proper conduct. You will need to follow these directions exactly and without question. Do you agree?"

"O. K.," said Voorland. "I haven't much choice."

Again he felt himself moving down another steeply slanted channel.

Suddenly, a spot of pale, bottle-green light appeared ahead. Rapidly it enlarged, and Voorland, half-blinded, realized that here the channel again entered an open grotto in this protoplasmic ocean—a grotto filled with green light.

Solid rock abruptly pressed upward against his body, and, with a happy sense of freedom, he scrambled to his feet, stood upright on that smooth surface.

Ahead of him a bulging facade of corroded metal rose vertically. The greenish radiance that filled the grotto seemed to have its source in a round, brilliant disc high up on this metal wall.

Clearly came the psychic voice of his crystalline guide.

"Before you is the entrance to the



The lever moved under his hand—and the pressing world of protoplasm heaved, writhed, and flooded inward!

dwelling of the Sigarians. Just underneath the green disc is a door. Proceed to this door, whereupon I will further instruct you."

Voorland walked over that flat surface of rock. As he neared the disc, the greenish brilliance intensified around him, and he became aware of a strange

prickling sensation throughout his body, as of high-voltage electricity. But he had no difficulty in locating the door, a large, elliptical affair of ribbed metal.

"You are to open the door," came a second mental order. "Just within, on your right, you will discover a lever. Pull this lever down. It operates a signal which will summon the Sigarians. When they appear I will intercede with them in your behalf, and give you further instructions."

VOORLAND'S hands grasped the rim of the door. But before he attempted to open it, he glanced back. Brilliantly lighted by that greenish glare was the concave surface of the grotto, like a huge bubble clinging to the angle formed by the rock floor and this metal structure. Through his mind flashed a momentary dread, not of that honey-combed horror of strange life from which he had just emerged, but of those pallid white creatures, the Sigarians, into whose hands he was about to thrust himself.

"Hope my little green friend isn't kidding me," he thought. "I imagine it'll take some high-pressure backing to get me in solid with these babes. Well, here goes——"

He pulled on the door. It opened ponderously.

"Queer!" he muttered. "They leave their door unlocked and the porch light on—maybe they're expecting me."

Before him stretched a corridor, metal-walled, and lighted with a pale, opalescent glow. But nothing moved in that corridor—it was completely deserted, utterly silent.

Voorland stepped inside. Near the entrance he found the lever—a metal arm working in a vertical slot. A queer doorbell, he thought, but nothing prompted him to disobey the instructions he had received. He grasped the lever, pulled it down.

Immediately, a vague rushing sound from outside the open doorway made him whirl, his hand still on the lever.

In the split-second that followed, Voorland's reactions were merely instinctive. His glance swept through the door. The green light was gone. Only darkness lay outside there—darkness and that rushing sound. But a pronounced sense of menace, and the vague notion that he was being tricked, stiffened him, contracted the muscles in his arm.

He shot the lever back in place. The green light snapped on. That rushing sound ended in what was almost a snarl—a hiss of frustration and rage. Before Voorland's eyes boiled a writhing wall of protoplasm, now less than six feet from the doorway. But it was pressing back in anguish—retreating under the stinging effulgence of that green light.

And in a flash Voorland realized that the thinking crystals had been using him merely as a cat's paw. The greenish light was more than light; it was a guard placed there over the entrance to keep back the protoplasmic ocean from those who dwelt within this sunken dome of metal.

Abruptly that silent corridor behind Voorland burst into life and sound. Forms surged along it toward him——

Something intangible struck him, seemed to burst inside his skull and numb his brain. There came a great darkness——

WHEN VOORLAND again became aware of continued existence, his first impression was that of subdued voices around him, and of a languorous weakness throughout his body.

At first it was too much of an effort even to think. But after a time he sensed that he was lying on a smooth, level surface which felt like polished metal, and that over him was suspended a limpid globe of soft light that seemed to lave him in its cool, healing rays.

Someone was bending over him, speaking in a foreign tongue. But, strangely, Voorland's mind automatically interrupted those words.

"I am Lator," said the voice. "You have been near death from the neural-ray, but you are now out of danger and among friends."

Memory suddenly returned to Voorland. He propped himself up on one elbow, stared around. At first he was conscious only of that circle of faces staring back at him—clean-cut, alertly intelligent faces. Human faces!

Astounded, he realized that these were men grouped around him—men dressed in queer, outlandish togas of green, iridescent triangles that overlapped to form a kind of metallic fabric; and their features, although human, were disturbingly anomalous, alien.

"Where am I?" he gasped. "I thought — Where are the Sigarians?"

"You are aboard the space ship *Nancildredth*," answered the thin-faced patriarch who had given his name as Lator. "We are lying stranded underneath the living blanket that covers this terrible planet, Baramthi. And we whom you see around you are the Sigarians."

"You—? The Sigarians!" Voorland struggled to sit up. Strength was rapidly returning to him. "But I thought that—"

"While you were under the healing ray," said Lator, "we took the liberty to probe your latent memory and to establish grounds for mutual understanding. You must realize that you were purposely deceived, by the Quasipeds, into believing we were hideous creatures. The Quasipeds—which is the name we have given to the intelligent crystals who rule this planet—wished to use you in their campaign against us. In this they were very nearly successful. Had you not reestablished the guard-ray immediately, we would have been swept by an inrush of protoplasm. We deeply regret that in our sudden

alarm we misunderstood your purpose. But I still cannot understand why the port was left unlocked."

"Perhaps I can explain that," said one of the others. "Ribel is absent."

There was a moment of silence. "You mean," demanded Lator, "that Ribel has left the ship secretly? Without my knowledge? I cannot understand it! Search the ship. Two of you return to the port, so that he may reënter if he is indeed outside."

A moment later Voorland and Lator were left alone.

Voorland sat up on the metal plate, looked curiously around. The room was octagonal in shape, rather large, and the metal plate on which he had been lying probably represented a surgical table. Over it was raised the thick arm of an odd-appearing apparatus, of which the luminous globe was that most understandable feature.

"I shall endeavor to acquaint you with conditions here," said Lator. "Over a decade ago we left our world, Sigaria, on a voyage of cosmic exploration—three hundred causists and students. The *Nancildredth* was equipped to travel not only across the normal geodesics of space, but also to cut across through hyperspace from one space-time continuum to another. Thus we were enabled to traverse inconceivable distances with no lapse of time whatever.

"Our voyage up to a certain point was wonderfully successful; but when near this planet, Baramthi, our fuel element became altered, due to unshielded radiations, and was rendered useless.

"TWO COURSES offered—either to consign ourselves to an eternal drift through space, or to try to land on Baramthi. We chose the latter, hoping to replenish our fuel. But we very nearly suffered annihilation by impact. The force of our landing was so great as to drive the *Nancildredth* beneath the surface of this protoplasmic ocean,

whereupon we continued sinking down to bedrock.

"We lie here now, anchored against the rocky core of Baramthi, helplessly stranded. We have exhausted every possibility of refueling our motors. This planet seems to be devoid of the element we require. Time—an eternity, it seems—has passed, and now there are scarcely two score of us left."

Lator paused, his white beard drooping disconsolately.

Just at this instant one of the searching party returned.

"O Lator," he spoke hurriedly, but respectfully, "we have discovered the reason for Ribel's absence. As you are aware, he has long been working on a device intended to detect the possible presence of the red metal we need to refuel our motors. Now, however, this device is gone. We believe that Ribel, not wishing to arouse our hopes vainly, but having noticed some positive reaction, has taken his device with him and has gone outside the ship to continue his search."

"Let us hope," said Lator, "that he will return safely."

"But how is it possible for anyone to go outside?" asked Voorland.

Lator smiled grimly. "Very simple. We have collected several specimens of Quasipeds. It is only necessary to take one of these along, when going outside, threatening it with instant disintegration should the way be blocked. As you know, their strange mental control of the protoplasmic body in which we are sunk allows them to open a channel through it at will. But being inanimate in a physical sense, they are markedly helpless when removed from it. I fear that our past research among their numbers has aroused great hatred—although we were not intentionally cruel. Come, my son, if you are sufficiently recovered you will wish to view our ship—a prison that Fate has doomed you to share with us."

Somewhat dazedly, Voorland followed the aged Sigarian on a tour of inspection. Within a short time he came to realize that this sunken structure was of truly colossal proportions. Besides dormitory facilities and control-room, it contained an astronomical observatory, library, and strangely outfitted laboratory.

The search for Ribel was still underway, on the off-chance that he was somewhere aboard. Lator asked many questions, although he seemed to be surprisingly well acquainted with Voorland's recent catastrophe.

"For years," he explained, "we have managed to synthesize food from proteid molecules of the surrounding protoplasm. We have sunk shafts into the rock underneath the ship for necessary chemicals, and in the vain hope of discovering traces of the red metal which would mean our salvation. But this element, scarce even on Sigaria, our home planet, seems to be absolutely nonexistent here on Baramthi."

"Isn't the ship hopelessly damaged, after lying here so long?" asked Voorland.

"Not at all," declared Lator. "We immediately repaired all injuries sustained in landing, and throughout our exile we have kept the machinery in perfect condition. We hoped that somehow we might gain a supply of the necessary fuel, either by transmutation or from some local source. Come—I will show you the motor room."

HE LED the way to a light metal stairway descending into a huge, pit-like chamber in the bowels of the ship. Voorland followed, his mind attempting to adjust itself to the strange turn his fortunes had taken.

Lator paused at the foot of the stairs, gestured with a thin arm toward the huge mechanism towering above them.

"There," he said brokenly, "is our only hope of ever leaving Baramthi."

But for a long time it has remained silent, lifeless, needing only a scrap of the red metal to reanimate it and enable us to blast free from this accursed orb!"

Voorland's gaze swept the huge structure—an atomic motor, he thought, but more than that—a machine capable of utilizing its released energy in some unknown fashion.

"For a long time," continued Lator, "we hoped that in the Quasipeds themselves we might locate the essential element. As you have probably observed, collectively they resemble a varied assortment of crystalline minerals, such as commonly occur on many orbs throughout space. But on analysis these lumps of matter revealed an astoundingly complex molecular and atomic structure, quite at variance with natural crystallization. Each gave very startling and unexpected reactions. Why this should be, I do not know, except that Baramthi is an exceedingly ancient planet, and matter here may have—evolved, so to speak."

"I believe that's in accordance with what my crystalline friend, the green beryl, gave me to understand," observed Voorland.

Lator nodded. "Possibly. But that doesn't explain certain buried ruins we have found along the rocks. I think we must look deeper. I cannot read the cosmic riddle of what may have occurred here; but I believe that what we see here is the aftermath of some ancient tragedy—some miscarriage of human experimentation."

"This element you need for fuel," mused Voorland, "this red metal—exactly what is it?"

Lator smiled dejectedly. "A very rare metal," he explained. "Sigaria, our home planet, contains but a minute quantity. But we thought, at the commencement of our journeying, that our supply was ample, for we carried with us over fifty pounds of the stuff. It is a

soft, reddish, metallic element, atomic weight sixty-three point six——"

Excited shouting from overhead interrupted Lator's words. Looking up, Voorland saw a group of Sigarians descending the stairs with tumultuous haste.

"Lator! Lator!" they were crying. "Ribel has returned! He has found the red metal!"

Voorland saw the lank frame of his patriarchal host stiffen.

"Come," said Lator, his voice oddly hoarse. "Let us see what Ribel has discovered."

Voorland ascended the stairs and hurried down a corridor in the wake of these queer exiles. At the end of the corridor was another excited group collected around an open port—the same, Voorland realized, through which he himself had gained entrance to the ship.

On Lator's arrival they all crowded through the port. Voorland followed after them, out into that mephitic green radiance.

"Ribel has found the red metal!" they were shouting.

THERE ON that semicircle of rock whose outer boundary was the pallid, concave surface of protoplasm, stood Ribel. He was clad in an odd-appearing armor. In his hands he was holding what appeared to be a thick piece of insulated cable.

"The red metal!" exclaimed Ribel, pointing to the end of the cable where the insulation had been scraped off.

"Copper!" muttered Voorland.

And then he saw behind Ribel the six huge electromagnets, the motor and disc, which had opened for him the passage-way hither through space. All were lying on the rock floor, well clear of the living wall beyond. And the cable that Ribel held was attached to one of these magnets.

Then Voorland realized that the Sigarians were all looking at him, and that

Lator was speaking, his wrinkled face working eagerly.

"The red metal! Ribel has indeed found the red metal—but these strange objects are not ours. They belong to our young friend here."

Silence greeted his words—silence through which swept an occasional groan of disappointment. Evidently, in these strange people, the sense of ownership and justice was highly developed.

"You're sure it's what you need to refuel the ship?" asked Voorland.

Lator nodded. "It is the red metal."

"O. K.," said Voorland. "I'm as anxious to get away from here as you are. Go ahead; use it."

A pleased shout followed his words. Lator's face crinkled into a smile.

"My son," he said, "you have won our eternal gratitude. And you shall not regret your action. Before ever we set foot on Sigaria, we shall return you to your own proper sphere—Earth, I believe you name it. Thus we swear! Is it not so?" he asked, turning to the others.

A ready shout of agreement arose from them, and they immediately began dragging one of the huge magnets in through the port.

"You are now one of us," said Lator, placing his hand on Voorland's arm. "But for a time we shall be very busy.

Make yourself at home. None of us shall know sleep until after the *Nancildredth* has swung out through space from this accursed orb, this nightmare planet—Baramthi!"

PERHAPS eight hours later, Voorland was standing in the control room of the *Nancildredth*, with Lator and a young Sigarian pilot.

All was in readiness for departure.

Lator himself grasped the control lever that would send them into space. His thin, old face bore evidence of the strain he was under. Voorland watched the lever ease over—

Suddenly, the floor jolted, pressed upward against his feet.

There came a sound, at first like wet snow sliding off a roof, then like the tearing of crisp silk. Sunlight abruptly smote Voorland's eyes, filling the control room with a blue-white splendor.

"Thank Heaven!" he gasped. "The old pill has blasted loose!"

Lator smiled triumphantly. "As soon as our velocity is high enough, we'll slip into hyper-space. Then we'll head for your planet. Already our automatic sequence calculator has been set in the reverse, and is tracing out your world-line. We haven't forgotten our promise!"

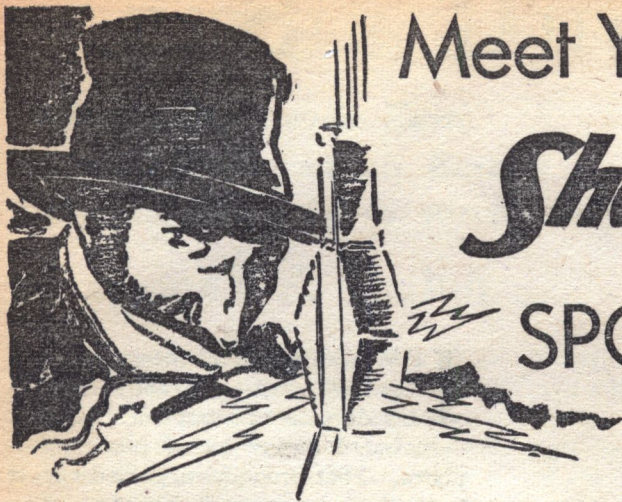
"I imagine Mac is fretting his silly head off," said Voorland, smiling. "He'll be surprised when I walk in on him."

In July

Astounding Science-Fiction

Voyage 13 by

RAY CUMMINGS



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WJBO	Baton Rouge, La.	KVSO	Ardmore, Okla.	WIBU	Beaver Dam, Wis.
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SEEDS

*A novelette
grows old
folk*

by

IT WAS a spore, microscopic in size. Its hard shell—resistant to the utter dryness of interplanetary space—harbored a tiny bit of plant protoplasm. That protoplasm, chilled almost to absolute zero, possessed no vital pulsation now—only a grim potentiality, a savage capacity for revival, that was a challenge to Fate itself.



Kaw, the Crow, recognized in this thing that it was alien—not of Earth—and that, to him, spelled danger to himself and all his kind.

OF THE DUSK

*of the days when Earth
and cold—when all Earth's
are keening wits to survive—*

Raymond Z. Gallun

For years the spore had been drifting and bobbing erratically between the paths of Earth and Mars, along with billions of other spores of the same kind. Now the gravity of the Sun drew it a few million miles closer to Earth's orbit, now powerful magnetic radiations from solar vortices forced it back toward the world of its origin.

It seemed entirely a plaything of chance. And, of course, up to a point it was. But back of its erratic, unconscious wanderings, there was intelligence that had done its best to take advantage of the law of averages.

The desire for rebirth and survival was the dominant urge of this intelligence. For this was during the latter days, when Earth itself was showing definite signs of senility, and Mars was near as dead as the Moon.

Strange, intricate spore-pods, conceived as a man might conceive a new invention, but put into concrete form by a process of minutely exact growth control, had burst explosively toward a black, spacial sky. In dusty clouds the spores had been hurled upward into the vacuum thinness that had once been an extensive atmosphere. Most of them had, of course, dropped back to the red, arid soil; but a comparative few, buffeted by feeble air currents, and measured numerically in billions, had found their way from the utterly tenuous upper reaches of Mars' gaseous envelope into the empty ether of the void.

With elements of a conscious purpose

added, the thing that was taking place was a demonstration of the ancient Arhenius Spore Theory, which, countless ages ago, had explained the propagation of life from world to world.

The huge, wonderful parent growths were left behind, to continue a hopeless fight for survival on a burnt-out world. During succeeding summer seasons they would hurl more spores into the interplanetary abyss. But soon they themselves would be only brown, mummied relics—one with the other relics of Mars; the gray, carven monoliths; the strange, hemispherical dwellings, dotted with openings arranged like the cells of a honeycomb. Habitations of an intelligent animal folk, long perished, who had never had use for halls or rooms, as such things are known to men, on Earth.

THE ERA of utter death would come to Mars, when nothing would move on its surface except the shadows shifting across dusty deserts, and the molecules of sand and rock vibrating with a little warmth from the hot, though shrunken, Sun. Death—complete death! But the growths which were the last civilized beings of Mars had not originated there. Once they had been on the satellites of Jupiter, too. And before that—well, perhaps even the race memory of their kind had lost the record of those dim, distant ages. Always they had waited their chance, and when the time came—when a world was physically suited for their development—they had acted.

A single spore was enough to supply the desired foothold on a planet. Almost inevitably—since chance is, in fundamentals, a mathematical element depending on time and numbers and repetition—that single spore reached the upper atmosphere of Earth.

For months, it bobbed erratically in tenuous, electrified gases. It might have been shot into space again. Upward and downward it wandered; but with gravity to tug at its insignificant mass, probability favored its ultimate descent to the harsh surface.

It found a resting place, at last, in a frozen desert gully. Around the gully were fantastic, sugar-loaf mounds. Near-by was one thin, ruined spire of blue porcelain—an empty reminder of a gentler era, long gone.

The location thus given to it seemed hardly favorable in its aspect. For this was the northern hemisphere, locked now in the grip of a deadly winter. The air, depleted through the ages, as was the planet's water supply, was arid and thin. The temperature, though not as rigorous and deadening as that of interplanetary space, ranged far below zero. Mars in this age was near dead; Earth was a dying world.

But perhaps this condition, in itself, was almost favorable. The spore belonged to a kind of life developed to meet the challenge of a generally much less friendly environment than that of even this later-day Earth.

There was snow in that desert gully—maybe a quarter-inch depth of it. The rays of the Sun—white and dwarfed after so many eons of converting its substance into energy—did not melt any of that snow even at noon. But this did not matter. The life principle within the spore detected favorable conditions for its germination, just as, in spring, the vital principle of Earthly seeds had done for almost incalculable ages.

By a process parallel to that of simple fermentation, a tiny amount of heat

was generated within the spore. A few crystals of snow around it turned to moisture, a minute quantity of which the alien speck of life absorbed. Roots finer than spiderweb grew, groping into the snow. At night they were frozen solid, but during the day they resumed their brave activity.

The spore expanded, but did not burst. For its shell was a protecting armor which must be made to increase in size gradually without rupture. Within it, intricate chemical processes were taking place. Chlorophyll there was absorbing sunshine and carbon dioxide and water. Starch and cellulose and free oxygen were being produced.

SO FAR, these processes were quite like those of common terrestrial flora. But there were differences. For one thing, the oxygen was not liberated to float in the atmosphere. It had been ages since such lavish waste had been possible on Mars, whose thin air had contained but a small quantity of oxygen in its triatomic form, ozone, even when Earth was young.

The alien thing stored its oxygen, compressing the gas into the tiny compartments in its hard, porous, outer shell. The reason was simple. Oxygen, combining with starch in a slow, fermentive combustion, could produce heat to ward off the cold that would otherwise stop growth.

The spore had become a plant now. First, it was no bigger than a pinhead. Then it increased its size to the dimensions of a small marble, its fuzzy, green-brown shape firmly anchored to the soil itself by its long, fibrous roots. Like any terrestrial growth, it was an intricate chemical laboratory, where transformations took place that were not easy to comprehend completely.

And now, perhaps, the thing was beginning to feel the first glimmerings of a consciousness, like a human child rising out of the blurred, unremembering

fog of birth. Strange, oily nodules, scattered throughout its tissues, connected by means of a complex network of delicate, white threads, which had the functions of a nervous system, were developing and growing—giving to the spore-plant from Mars the equivalent of a brain. Here was a sentient vegetable in the formative stage.

A sentient vegetable? Without intelligence it is likely that the ancestors of this nameless invader from across the void would long ago have lost their battle for survival.

What senses were given to this strange mind, by means of which it could be aware of its environment? Undoubtedly it possessed faculties of sense that could detect things in a way that was as far beyond ordinary human conception as vision is to those individuals who have been born blind. But in a more simple manner it must have been able to feel heat and cold and to hear sounds, the latter perhaps by the sensitivity of its fine, cilia-like spines. And certainly it could see in a way comparable to that of a man.

For, scattered over the round body of the plant, and imbedded deep in horny hollows in its shell, were little organs, lensed with a clear, vegetable substance. These organs were eyes, developed, perhaps, from far more primitive light-sensitive cells, such as many forms of terrestrial flora possess.

BUT DURING those early months, the spore plant saw little that could be interpreted as a threat, swiftly to be fulfilled. Winter ruled, and the native life of this desolate region was at a standstill.

There was little motion except that of keen, cutting winds, shifting dust, and occasional gusts of fine, dry snow. The white, shrunken Sun rose in the east, to creep with protracted slowness across the sky, shedding but the barest trace of

warmth. Night came, beautiful and purple and mysterious, yet bleak as the crystalline spirit of an easy death.

Through the ages, Earth's rate of rotation had been much decreased by the tidal drag of Solar and Lunar gravities. The attraction of the Moon was now much increased, since the satellite was nearer to Terra than it had been in former times. Because of the decreased rate of rotation, the days and nights were correspondingly lengthened.

All the world around the spore plant was a realm of bleak, unpeopled desolation. Only once, while the winter lasted, did anything happen to break the stark monotony. One evening, at moonrise, a slender metal car flew across the sky with the speed of a bullet. A thin propelling streamer of fire trailed in its wake, and the pale moonglow was reflected from its prow. A shrill, mechanical scream made the rarefied atmosphere vibrate, as the craft approached to a point above the desert gully, passed, and hurtled away, to leave behind it only a startling silence and an aching memory.

For the spore plant did remember. Doubtless there was a touch of fear in that memory, for fear is a universal emotion, closely connected with the law of self-preservation, which is engrained in the texture of all life, regardless of its nature or origin.

Men. Or rather, the cold, cruel, cunning little beings who were the children of men. The Itorloo, they called themselves. The invader could not have known their form as yet, or the name of the creatures from which they were descended. But it could guess something of their powers from the flying machine they had built. Inherited memory must have played a part in giving the queer thing from across the void this dim comprehension. On other worlds its ancestors had encountered animal folk possessing a similar science. And the spore plant was surely aware that here on Earth the builders of this

speeding craft were its most deadly enemies.

The Itorloo, however, inhabiting their vast underground cities, had no knowledge that their planet had received an alien visitation—one which might have deadly potentialities. And in this failure to know, the little spore plant, hidden in a gully where no Itorloo foot had been set in a thousand years, was safe.

Now there was nothing for it to do but grow and prepare to reproduce its kind, to be watchful for lesser enemies, and to develop its own peculiar powers.

IT IS NOT to be supposed that it must always lack, by its very nature, an understanding of physics and chemistry and biological science. It possessed no test tubes, or delicate instruments, as such things were understood by men. But it was gifted with something—call it an introspective sense—which enabled it to study in minute detail every single chemical and physical process that went on within its own substance. It could feel not only the juices coursing sluggishly through its tissues, but it could feel, too, in a kind of atomic pattern, the change of water and carbon dioxide into starch and free oxygen.

Gift a man with the same power that the invader's kind had acquired, perhaps by eons of practice and directed will—that of feeling vividly even the division of cells, and the nature of the protoplasm in his own tissues—and it is not hard to believe that he would soon delve out even the ultimate secret of life. And in the secret of life there must be involved almost every conceivable phase of practical science.

The spore plant proceeded with its marvelous self-education, part of which must have been only recalling to mind the intricate impressions of inherited memories.

Meanwhile it studied carefully its bleak surroundings, prompted not only

by fear, but by curiosity as well. To work effectively, it needed understanding of its environment. Intelligence it possessed beyond question; still it was hampered by many limitations. It was a plant, and plants have not an animal's capacity for quick action, either of offense or defense. Here, forever, the entity from across the void was at a vast disadvantage, in this place of pitiless competition. In spite of all its powers, it might now have easily been destroyed.

The delicate, ruined tower of blue porcelain, looming up from the brink of the gully— The invader, scrutinizing it carefully for hours and days, soon knew every chink and crack and fanciful arabesque on its visible side. It was only a ruin, beautiful and mysterious alike by sunshine and moonlight, and when adorned with a fine sifting of snow. But the invader, lost on a strange world, could not be sure of its harmlessness.

Close to the tower were those rude, high, sugar-loaf mounds, betraying a sinister cast. They were of hard-packed Earth, dotted with many tiny openings. But in the cold, arid winter, there was no sign of life about them now.

All through those long, arctic months, the spore plant continued to develop, and to grow toward the reproductive stage. And it was making preparations too—combining the knowledge acquired by its observations with keen guesswork, and with a science apart from the manual fabrication of metal and other substances.

II.

A Milder season came at last. The Sun's rays were a little warmer now. Some of the snow melted, moistening the ground enough to germinate Earthly seeds. Shoots sprang up, soon to develop leaves and grotesque, devilish-looking flowers.

In the mounds beside the blue tower a slow awakening took place. Millions

of little, hard, reddish bodies became animated once more, ready to battle grim Nature for sustenance. The ages had done little to the ants, except to increase their fierceness and cunning. Almost any organic substances could serve them as food, and their tastes showed but little discrimination between one dainty and another. And it was inevitable, of course, that presently they should find the spore plant.

Nor were they the latter's only enemies, even in this desert region. Of the others, Kaw and his black-feathered brood were the most potent makers of trouble. Not because they would attempt active offense themselves, but because they were able to spread news far and wide.

Kaw wheeled alone now, high in the sunlight, his ebon wings outstretched, his cruel, observant little eyes studying the desolate terrain below. Buried in the sand, away from the cold, he and his mate and their companions had slept through the winter. Now Kaw was fiercely hungry. He could eat ants if he had to, but there should be better food available at this time of year.

Once, his keen eyes spied gray movement far below. As if his poised and graceful flight was altered by the release of a trigger, Kaw dived plummet-like and silent toward the ground.

His attack was more simple and direct than usual. But it was successful. His reward was a large, long-tailed rodent, as clever as himself. The creature uttered squeaks of terror as meaningful as human cries for help. In a moment, however, Kaw split its intelligently rounded cranium with a determined blow from his strong, pointed beak. Bloody brains were devoured with indelicate gusto, to be followed swiftly by the less tasty flesh of the victim. If Kaw had ever heard of table manners, he didn't bother with them. Kaw was intensely practical.

His crop full, Kaw was now free to

exercise the mischievous curiosity which he had inherited from his ancient forbears. They who had, in the long-gone time when Earth was young, uprooted many a young corn shoot, and had yammered derisively from distant treetops when any irate farmer had gone after them with a gun.

With a clownish skip of his black, scaly feet, and a show-offish swerve of his dusty, ebon wings, Kaw took to the air once more. Upward he soared, his white-lidded eyes directed again toward the ground, seeking something interesting to occupy his attention and energies.

Thus, presently, he saw a brownish puff that looked like smoke or dust in the gully beside the ruined blue tower at the pinnacle of which he and his mate were wont to build their nest in summer. Sound came then—a dull, ringing pop. The dusty cloud expanded swiftly upward, widening and thinning until its opacity was dissipated into the clearness of the atmosphere.

KAW WAS really startled. That this was so was evinced by the fact that he did not voice his harsh, rasping cry, as he would have done had a lesser occurrence caught his attention. He turned back at first, and began to retreat, his mind recognizing only one possibility in what had occurred. Only the Itorloo, the Children of Men, as far as he knew, could produce explosions like that. And the Itorloo were cruel and dangerous.

However, Kaw did not go far in his withdrawal. Presently—since there were no further alarming developments—he was circling back toward the source of the cloud and the noise. But for many minutes he kept what he considered a safe distance, the while he tried to determine the nature of the strange, bulging, grayish-green thing down there in the gully.

A closer approach, he decided finally, was best made from the ground. And so he descended, alighting several hun-

dred yards distant from the narrow pocket in the desert.

Thence he proceeded to walk cautiously forward, taking advantage of the cover of the rocks and dunes, his feathers gleaming with a dusty, rainbow sheen, his large head bobbing with the motion of his advance like any fowl's. His manner was part laughably ludicrous, part scared, and part determined.

And then, peering from behind a large boulder, he saw what he had come to see. It was a bulging, slightly flattened sphere, perhaps a yard across. From it projected flat, oval things of a gray-green color, like the leaves of a cactus. And from these, in turn, grew clublike protuberances of a hard, horny texture—spore-pods. One of them was blasted open, doubtless by the pressure of gas accumulated within it. These spore-pods were probably not as complexly or powerfully designed as those used by the parent growths on Mars, for they were intended for a simpler purpose. The entire plant bristled with sharp spines, and was furred with slender hairs, gleaming like little silver wires.

Around the growth, thousands of ant bodies lay dead, and from its vicinity other thousands of living were retreating. Kaw eyed these evidences critically, guessing with wits as keen as those of a man of old their sinister significance. He knew, too, that presently other spore-pods would burst with loud, disturbing noises.

Kaw felt a twinge of dread. Evolution, working through a process of natural selection—and, in these times of hardship and pitiless competition, putting a premium on intelligence—had given to his kind a brain power far transcending that of his ancestors. He could observe, and could interpret his observations with the same practical comprehension which a primitive human being might display. But, like those primitives, he had developed, too, a capacity to feel superstitious awe.

That gray-green thing of mystery had a fantastic cast which failed to identify it with—well—with naturalness. Kaw was no botanist, certainly; still he could recognize the object as a plant of some kind. But those little, bright, eye-lenses suggested an unimaginable scrutiny. And those spines, silvery in sheen, suggested ghoulish animation, the existence of which Kaw could sense as a nameless and menacing unease.

HE COULD guess, then, or imagine—or even know, perhaps—that here was an intruder who might well make itself felt with far-reaching consequences in the future. Kaw was aware of the simple fact that most of the vegetation he was acquainted with grew from seeds or the equivalent. And he was capable of concluding that this flattened spheroid reproduced itself in a manner not markedly unfamiliar. That is, if one was to accept the evidence of the spore-pods. Billions of spores, scattering with the wind! What would be the result?

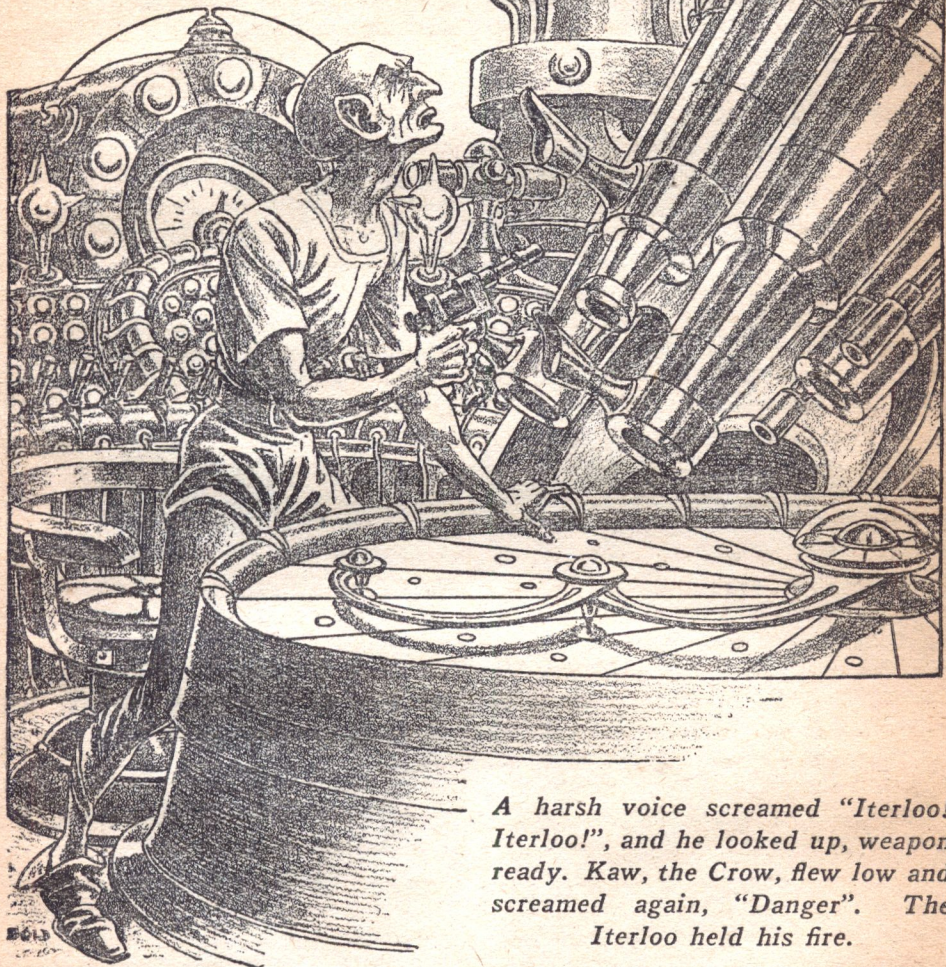
Kaw would not have been so troubled, were it not for those crumpled thousands of ant bodies, and the enigma of their death. It was clear that the ants had come to feed on the invader—but they had perished. How? By some virulent plant poison, perhaps?

The conclusions which intelligence provides can produce fear where fear would otherwise be impossible. Kaw's impulse was to seek safety in instant departure, but horror and curiosity fascinated him. Another deeper, more reasoned urge commanded him. When a man smells smoke in his house at night, he does not run away; he investigates. And so it was with Kaw.

He hopped forward cautiously toward the invader. A foot from its rough, curving side he halted. There, warily, as if about to attack a poisonous lizard, he steeled himself. Lightly and swiftly his beak shot forward. It touched the tip of a sharp spine.

The result left Kaw dazed. It was as though he had received a stunning blow on the head. A tingling, constricting sensation shot through his body, and he was down, flopping in the dust.

Electricity. Kaw had never heard of such a thing. Electricity generated chemically in the form of the invader,



A harsh voice screamed "Iterloo! Iterloo!", and he looked up, weapon ready. Kaw, the Crow, flew low and screamed again, "Danger". The Iterloo held his fire.

by a process analogous to that by which, in dim antiquity, it had been generated in the bodies of electric eels and other similar creatures.

However, there was a broad difference here between the subject and the analogy. Electric eels had never understood

the nature of their power, for they were as irresponsible for it as they were irresponsible for the shape of the flesh in which they had been cast. The spore plant, on the other hand, comprehended minutely. Its electric organs had been minutely preplanned and conceived be-

fore one living cell of their structure had been caused to grow on another. And these organs were not inherited, but were designed to meet the more immediate needs of self-protection. During the winter, the invader, studying its surroundings, had guessed well.

Slowly Kaw's brain cleared. He heard an ominous buzzing, and knew that it issued from the plant. But what he did not know was that, like the electric organs, the thing's vocal equipment was invented for possible use in its new environment. For days, since the coming of spring, the invader had been listening to sounds of various kinds, and had recognized their importance on Earth.

Now Kaw had but one thought, and that was to get away. Still dazed and groggy, he leaped into the air. From behind him, in his hurried departure, he heard a dull plop. More billions of spores, mixing with the wind, to be borne far and wide.

BUT NOW, out of his excitement, Kaw drew a reasoned and fairly definite purpose. He had a fair idea of what he was going to do, even though the course of action he had in mind might involve him with the greatest of his enemies. Yet, when it came to a choice, he would take the known in preference to the unknown.

He soared upward toward the bright blue of the heavens. The porcelain tower, the ant hills, and the low mounds which marked the entrances to the rodent colonies slipped swiftly behind. As if the whole drab landscape were made to move on an endless belt.

Kaw was looking for his mate, and for the thirty-odd, black-winged individuals who formed his tribe. Singly and in small groups, he contacted and collected them. Loud, raucous cries, each with a definite verbal meaning, were exchanged. Menace was on the Earth—bizarre, nameless menace. Excitement grew to fever pitch.

Dusk, beautiful and soft and forbidding, found the bird clan assembled in a chamber high-placed in a tremendous edifice many miles from where Kaw had made his discovery. The building belonged to the same gentle culture which had produced the blue porcelain tower. The floor of the chamber was doubtless richly mosaiced. But these were relics of departed splendor now thickly masked with dust and filth.

From the walls, however, painted landscapes of ethereal beauty, and the faces of a happy humankind of long ago peeped through the gathering shadows. They were like ghosts, a little awed at what had happened to the world to which they had once belonged. Those gentle folk had dwelt in a kindlier climate which was now stripped forever from the face of the Earth. And they had been wiped out by creatures who were human too, but of a different, crueler race.

Through delicately carved screens of pierced marble, far up on the sides of the chamber's vast, brooding rotunda, the fading light of day gleamed, like a rose glow through the lacework of fairies.

But this palace of old, dedicated to laughter and fun and luxury, and to the soaring dreams of the fine arts, was now only a chill, dusty gathering place for a clan of black-winged, gruesome harpies.

They chuckled and chattered and cawed, like the crows of dead eras. But these sounds, echoing eerily beneath cloistered arches, dim and abhorrent in the advancing gloom of night, differed from that antique yammering. It constituted real, intelligent conversation.

Kaw, perched high on a fancifully wrought railing of bronze, green with the patina of age, urged his companions with loud cries, and with soft, pleading notes. In his own way, he had some of the qualities of a master orator. But, as all through an afternoon of similar arguing,

he was getting nowhere. His tribe was afraid. And so it was becoming more and more apparent that he must undertake his mission alone. Even Teka, his mate, would not accompany him.

At last Kaw ruffled his neck feathers, and shook his head violently in an avian gesture of disgust. He leaped from his perch and shot through a glassless window with an angry scream that was like the curse of a black ghoul.

It was the first time that he had ever undertaken a long journey at night. But in his own judgment, necessity was such that no delay could be tolerated.

The stars were sharp and clear, the air chill and frosty. The ground was dotted sparsely with faint glimmerings from the chimneys of the crude furnaces which, during the colder nights of spring and fall, warmed the underground rodent colonies.

After a time the Moon rose, huge and yellow, like the eye of a monster. In that gloom and silence, Kaw found it easy to feel the creeping and imperceptible, yet avalanching, growth of horror. He could not be sure, of course, that he was right in his guess that the mission he had undertaken was grimly important. But his savage intuition was keen.

The Itorloo—the Children of Men—he must see them, and tell them what he knew. Kaw was aware that the Itorloo had no love for any but themselves. But they were more powerful than the winds and the movements of the Sun and Moon themselves. They would find a swift means to defeat the silent danger.

And so, till the gray dawn, Kaw flew on and on, covering many hundreds of miles, until he saw a low dome of metal, capping a hill. The soft half-light of early morning sharpened its outlines to those of a beautiful, ebon silhouette, peaceful and yet forbidding. Beneath it, as Kaw knew, was a shaft leading down to the wondrous underworld of the Itorloo, as intriguing to his mind as a shadowland of magic.

Fear tightened its constricting web around Kaw's heart—but retreat was something that must not be. There was too much at stake ever to permit a moment of hesitation.

Kaw swung into a wide arc, circling the dome. His long wings, delicately poised for a soaring glide, did not flap now, but dipped and rose to capture and make use of the lifting power of every vagrant wisp of breeze. And from his lungs issued a loud, raucous cry.

"Itorloo!" he screamed. "Itorloo!"

The word, except for its odd, parrot-like intonation, was pronounced in an entirely human manner. Kaw, in common with his crow ancestors, possessed an aptitude for mimicry of the speech of men.

Tensely he waited for a sign, as he swung lower and nearer to the dome.

III.

ZAR FELT irritable. He did not like the lonely surface vigil and the routine astronomical checkings that constituted his duty. All night he'd sat there at his desk with signal lights winking around him, helping surface watchers at the other stations check the position of a new meteor swarm by means of crossing beams of probe rays.

Angles, distances, numbers! Zar was disgusted. Why didn't the construction crews hurry? The whole race could have been moved to Venus long ago, and might just as well have been. For as far as Zar could see, there was no real reason to retain a hold on the burnt-out Earth. The native Venusians should have been crushed a century back. There wasn't any reason why this pleasant task shouldn't have been accomplished then—no reason except stupid, official inertia!

The sound of a shrill bird cry, throbbing from the pickup diaphragm on the wall, did not add any sweetening potion to Zar's humor. At first he paid no at-

tention; but the insistent screaming of the name of his kind—"Itorloo! Itorloo!"—at length aroused him to angry action.

His broad, withered face, brown and hideous and goblinlike, twisted itself into an ugly grimace. He bounded up from his chair, and seized a small, pistollike weapon.

A moment later he was out on the sandy slopes of the hill, looking up at the black shape that swooped and darted timidly, close to his head. On impulse Zar raised his weapon, no thought of compassion in his mind.

But Zar screamed again: "Itorloo! Loaaah!"

In Zar's language, "Loaaah!" meant "Danger!" very emphatically. Zar's hand, bent on execution, was stayed for the moment at least. His shrewd little eyes narrowed, and from his lips there issued yammering sounds which constituted an understandable travesty of the speech of Kaw's kind.

"Speak your own tongue, creature!" he ordered sharply. "I can understand!"

Still swooping and darting nervously, Kaw screamed forth his story, describing in quaint manner the thing he had seen, employing comparisons such as any primitive savage would use. In this way the invader was like a boulder, in that way it was like a thorn cactus, and in other ways it resembled the instruments of death which the Itorloo employed. In all ways it was strange, and unlike anything ever seen before.

And Zar listened with fresh and calculated attention, getting from this bird creature the information he required to locate the strange miracle. Kaw was accurate and clear enough in giving his directions.

Zar might have forgotten his inherent ruthlessness where his feathered informer was concerned, had not Kaw become a trifle too insistent in his exhortations to action. He lingered too long and screamed too loudly.

Irritated, Zar raised his weapon. Kaw swept away at once, but there was no chance for him to get out of range. Invisible energy shot toward him. Black feathers were torn loose, and floated aflame in the morning breeze. Kaw gave a shrill shriek of agony and reproach. Erratically he wavered to the ground.

ZAR DID NOT even glance toward him, but retraced his way leisurely into the surface dome. An hour later, however, having received permission from his superiors, he had journeyed across those hundreds of miles to the gully beside the blue porcelain tower. And there he bent over the form of the invader. Zar was somewhat awed. He had never been to Mars. For two hundred thousand years or more, no creature from Earth had ever visited that planet. The Itorloo were too practical to attempt such a useless venture, and their more recent predecessors had lacked some of the adventurous incentive required for so great and hazardous a journey.

But Zar had perused old records, belonging to an era half a million years gone by. He knew that this gray-green thing was at least like the flora of ancient Mars. Into his mind, matter-of-fact for the most part, came the glimmerings of a mighty romance, accentuating within him a consciousness of nameless dread, and of grand interplanetary distances.

Spines. Bulging, hard-shelled, pulpy leaves that stored oxygen under pressure. Chlorophyl that absorbed sunshine and made starch, just as in an ordinary Earthly plant. Only the chlorophyl of this growth was beneath a thick, translucent shell, which altered the quality of the light it could reflect. That was why astronomers in the pre-interplanetary era had doubted the existence of vegetation on Mars. Green plants of Terra, when photographed with infrared light, looked silvery, like things of frost. But—because of their shells—

Martian vegetation could not betray its presence in the same manner.

Zar shuddered, though the morning air was not chill by his standards. The little gleaming orbs of the invader seemed to scrutinize him critically and coldly, and with a vast wisdom. Zar saw the shattered spore-pods, knowing that their contents now floated in the air, like dust—floated and settled—presenting a subtle menace whose tool was the unexpected, and against which—because of the myriad numbers of the widely scattered spores—only the most drastic methods could prevail.

Bêlatedly, then, anger came. Zar drew a knife from his belt. Half in fury and half in experiment, he struck the invader, chipping off a piece of its shell. He felt a sharp electric shock, though by no means strong enough to kill a creature of his size. From the wound he made in the plant, oxygen sized softly. But the invader offered no further defense. For the present it had reached the end of its resources.

Zar bounded back. His devilish little weapon flamed then, for a full two minutes. When he finally released pressure on its trigger, there was only a great, smouldering, glowing hole in the ground where the ghoulish thing from across space had stood.

Such was Zar's and the entire Itorloo race's answer to the intruder. Swift destruction! Zar chuckled wickedly. And there were ways to rid Earth of the treacherous menace of the plant intelligences of Mars entirely, even though they would take time.

Besides there was Venus, the world of promise. Soon half of the Itorloo race would be transported there. The others certainly could be accommodated if it became necessary.

NECESSARY? Zar laughed. He must be getting jittery. What had the Itorloo to fear from those inert, vegetable things? Now he aimed his weapon to-

ward the blue tower, and squeezed the trigger. Weakened tiles crumbled and fell down with a hollow, desolate rattle that seemed to mock Zar's ruthlessness.

Suddenly he felt sheepish. To every intelligent being there is a finer side that prompts and criticizes. And for a moment Zar saw himself and his people a little more as they really were.

Unlike the lesser creatures, the Children of Men had not advanced very much mentally. The ups and downs of history had not favored them. War had reversed the benefits of natural selection, destroying those individuals of the species best suited to carry it on to greater glory. Zar knew this, and perhaps his senseless assault upon the ruined building was but a subconscious gesture of resentment toward the people of long ago who had been kinder and wiser and happier.

Zar regretted his recent act of destroying the spore plant. It should have been preserved for study. But now—well—what was done could not be changed.

He entered his swift, gleaming rocket car. When he closed its cabin door behind him, it seemed that he was shutting out a horde of mocking, menacing ghosts.

In a short while he was back at the surface station. Relieved there of his duty by another little brown man, he descended the huge cylindrical shaft which dropped a mile to a region that was like the realm of the Cyclops: Thrumming sounds, winking lights, shrill shouts of the workers, blasts of incandescent flame, and the colossal majesty of gigantic machines, toiling tirelessly.

In a vast, pillard plaza the keels of spaceships were being laid—spaceships for the migration and the conquest. In perhaps a year—a brief enough time for so enormous a task—they would soar away from Earth, armed to the teeth. There would be thousands of the craft then, for all over the world, in dozens

of similar underground places, they were in process of construction.

Zar's vague fears were dissipated in thoughts of conquest to come. The Venus folk annihilated in withering clouds of flame. The glory of the Itorloo carried on and on——

IV.

KAW WAS NOT dead. That this was so was almost a miracle, made possible, perhaps, by a savage, indomitable will to live. In his small bird body there was a fierce, burning courage that compensated for many of his faults.

For hours he lay there on the desert sand, a pathetic and crumpled bundle of tattered feathers, motionless except for his labored breathing, and the blinking of his hate-filled eyes. Blood dripped slowly from the hideous, seared wound on his breast, and his whole body ached with a vast, dull anguish.

Toward sundown, however, he managed to hobble and flutter forward a few rods. Here he buried himself shallowly in the sand, where his chilled body would be protected from the nocturnal cold.

For three days he remained thus interred. He was too weak and sick to leave his burrow. Bitterness toward Zar and the other cruel Itorloo, he did not feel. Kaw had lived too long in this harsh region to expect favors. But a black fury stormed within him, nevertheless—a black fury as agonizing as physical pain. He wanted revenge. No, he needed revenge as much as he needed the breath of life. He did not know that Itorloo plans directed against the intruding spores from Mars were already under way, and that—as a by-product—they would destroy his own kind, and all primitive life on the surface of the Earth.

Kaw left his hiding place on the fourth day. Luck favored him, for he found a bit of carrion—part of the dead body of an antelope-like creature.

Somehow, through succeeding weeks and days, he managed to keep alive. The mending of his injured flesh was slow indeed, for the burnt wound was unclean. But he started toward home, hopping along at first, then flying a little, a hundred yards at a time. Tedium and pain were endless. But the fiendish light of what must seem forever fruitless hatred, never faded in those wicked, white-lidded eyes. Frequently Kaw's long, black beak snapped in a vicious expression of boundless determination.

Weeks of long days became a month and then two months. Starved to a black-clad skeleton, and hopeless of ever being fit to hunt again, Kaw tottered into a deep gorge one evening. Utterly spent, he sank to the ground here, his brain far too weary to take note of any subtle unusualness which the deepening shadows half masked.

He scarcely saw the rounded things scattered here. Had he noticed them, his blurred vision would have named them small boulders and nothing more. Fury, directed at the Itorloo, had made him almost forget the spore plants. He did not know that this was to be a place of magic. Chance and the vagrant winds had made it so. A hundred spores, out of many billions, had lodged here. Conditions had been just right for their swift development. It was warm, but not too warm. And there was moisture too. Distantly Kaw heard the trickle of water. He wanted to get to it, but his feebleness prevented him.

HE MUST have slept, then, for a long time. It seemed that he awoke at the sound of an odd buzzing, which may have possessed hypnotic properties. He felt as weak and stiff as before, but he was soothed and peaceful now, in spite of his thirst and hunger.

He looked about. The gorge was deep and shadowy. A still twilight pervaded it, though sunshine gilded its bulging, irregular lips far above. These de-

tails he took in in a moment.

He looked, then, at the grotesque shapes around him—things which, in the deeper darkness, he had thought to be only boulders. But now he saw that they were spore plants, rough, eerie, brooding, with their little, lensed light-sensitive organs agleam.

The excitement of terror seized him, and he wanted to flee, as from a deadly enemy. But this urge did not last long. The hypnotic buzz, which issued from the diaphragmic vocal organs of the plants, soothed and soothed and soothed, until Kaw felt very relaxed.

There were dead ants around him, doubtless the victims of electrocution. Since no better food was within reach, Kaw hopped here and there, eating greedily.

After that he hobbled to the brackish spring that dripped from the wall, and drank. Next he dropped to the ground, his fresh drowsiness characterized by sleepy mutterings about himself, his people, and the all-wise Itorloo. And it seemed, presently, that the buzzing of the invaders changed in character at last, seeming to repeat his own mutterings clumsily, like a child learning to talk.

"Kaw! Itorloo!" And other words and phrases belonging to the speech of the crow clans.

It was the beginning of things miraculous and wonderful for Kaw, the black-feathered rascal. Many suns rose and set, but somehow he felt no urge to wander farther toward his home region. He did not know the Lethean fascination of simple hypnotism. True, he sallied afield farther and farther, as his increasing strength permitted. He hunted now, eating bugs and beetles for the most part. But always he returned to the gorge, there to listen to the weird growths, buzzing, chattering, speaking to him in his own tongue. In them there seemed somehow to be a vague suggestion of the benigance of some

strange, universal justice, in spite of their horror.

And night and day, rocket cars, streamlined and gleaming, swept over the desert. Now and then beams of energy were unleashed from them, whipping the sand into hot flame, destroying the invading spore plants that had struck root here and there. Only the law of chance kept them away from the gorge, as doubtless it allowed them to miss other hiding places of alien life. For the wilderness was wide.

But this phase of the Itorloo battle against the invading spore plants was only a makeshift preliminary, intended to keep the intruders in check. Only the Itorloo themselves knew about the generators now being constructed far underground—generators which, with unseen emanations, could wipe out every speck of living protoplasm on the exposed crust of the planet. Theirs was a monumental task, and a slow one. But they meant to be rid, once and for all, of the subtle threat which had come perhaps to challenge their dominion of the Earth. Kaw and his kind, the rodents, the ants, and all the other simple People of the Dusk of Terra's Greatness, were seemingly doomed.

KAW'S HATRED of the Children of Men was undimmed, more justly than he was aware. Thus it was easy for him to listen when he was commanded: "Get an Itorloo! Bring him here! Alone! On foot!"

Zar was the logical individual to produce, for he was the nearest, the most readily available. But summer was almost gone before Kaw encountered the right opportunity, though he watched with care at all times.

Evening, with Venus and the Moon glowing softly in the sky. Kaw was perched on a hilltop, close to the great surface dome, watching as he had often watched before. Out of its cylindrical hangar, Zar's flier darted, and then

swung in a slow arc. Presently it headed at a leisurely pace into the north-west. For once its direction was right, and it was not traveling too fast for Kaw to keep pace with it. Clearly its pilot was engaged in a rambling pleasure jaunt, which had no definite objective.

Kaw, pleased and excited, fell in behind at a safe distance. There he remained until the craft was near the gorge. Now there was danger, but if things were done right—

He flapped his wings violently to catch up with his mechanical quarry. He screamed loudly: "Itorloo! Itorloo! Descend! Descend! I am Kaw, who informed you of the unknowns long ago! I would show you more! More! More!" All this in shrill, avian chattering.

Kaw's trickery was naively simple. But Zar heard, above the noise of his rocket blasts. Suspicion? He felt it, of course. There was no creature in this era who accepted such an invitation without question. Yet he was well armed. In his own judgment he should be quite safe. Curiosity led him on.

He shut off his rocket motors, and uttered the bird jargon, questioning irritably: "Where? What is it, black trickster?"

Kaw skittered about defensively. "Descend!" he repeated. "Descend to the ground! The thing that bears you cannot take you where we must go!"

The argument continued for some little time, primitive wit matching curiosity and suspicion.

And meanwhile, in the gloomy gorge cut in vague geologic times by some gushing stream, entities waited patiently. Sap flowed in their tissues, as in the tissues of any other vegetation, but the fine hairs on their forms detected sounds, and their light-sensitive cells served as eyes. Within their forms were organs equivalent to human nerve and brain. They did not use tools or metals, but worked in another way, dictated by their

vast disadvantages when compared to animal intelligences. Yet they had their advantages, too.

Now they waited, dim as bulking shadows. They detected the excited cries of Kaw, who was their instrument. And perhaps they grew a little more tense, like a hunter in a blind, when he hears the quacking of ducks through a fog.

There was a grating of pebbles, and a little brown man, clad in a silvery tunic, stepped cautiously into view. There was a weapon clutched in his slender hand. He paused, as if suddenly awed and fearful. But no opportunity to retreat was given him.

A SPORE-POD exploded with a loud plop in the confined space. A mass of living dust filled the gorge, like a dense, opaque cloud, choking, blinding. Zar squeezed the trigger of his weapon impulsively. Several of the invaders were blasted out of existence. Stones clattered down from where the unaimed beam of energy struck the wall.

Panic seized the little man, causing him to take one strangling breath. In a few moments he was down, writhing helpless on the ground. Choked by the finely divided stuff, his consciousness seemed to drop into a black hole of infinity. He, Zar, seemed about to pay for his misdeeds. With a mad fury he heard the derisive screams of Kaw, who had tricked him. But he could not curse in return, and presently his thoughts vanished away to nothing.

Awareness of being alive came back to him very slowly and painfully. At first he felt as though he had pneumonia—fever, suffocation, utter vagueness of mind. Had the spores germinated within his lungs, he would surely have died. But they did not, there; conditions were too moist and warm for them. Gradually he coughed them up.

He felt cold with a bitter, aching chill, for the weather had changed with

the lateness of the season. Fine snow sifted down into the gorge from clouds that were thin and pearly and sun-gilded. Each tiny crystal of ice glittered with a thousand prismatic hues as it slowly descended. And the silence was deathly, bearing a burden of almost tangible desolation. In that burden there seemed to crowd all the antique history of a world—history whose grand movement shaded gradually toward stark, eternal death.

Zar wanted to flee this awful place that had become like part of another planet. He jerked his body as if to scramble feebly to his feet. He found then that he was restrained by cordlike tendrils, hard as horn, and warm with a faint, fermentive, animallike heat. Like the beat of a nameless pulse, tiny shocks of electricity tingled his flesh in a regular rhythm.

It was clear to Zar that while he had been inert the tendrils had fastened themselves slowly around him, in a way that was half like the closing of an ancient Venus Flytrap, carnivorous plant of old, and half like the simple creeping of a vine on a wall.

Those constricting bonds were tightening now. Zar could feel the tiny thorns with which they were equipped biting into his flesh. He screamed in horror and pain. His cries echoed hollowly in the cold gorge. The snow, slowly sifting, and the silence, both seemed to mock—by their calm, pitiless lack of concern—the plight in which he found himself.

And then a voice, chattering faintly in the language of Kaw the Crow: "Be still. Peace. Peace. Peace. Peace. Peace——"

Gradually the sleepy tone quieted Zar, even though he was aware that whatever the invaders might do to him could bring him no good.

Plants with voices. Almost human voices! Some sort of tympanic organs, hidden, perhaps, in some of those pulpy

leaves, Zar judged. From the records of the old explorations of Mars, he knew a little about these intruders, and their scheme of life. Organs, with the functions of mechanical contrivances, conceived and grown as they were needed! An alien science, adapted to the abilities and limitations of vegetative intelligences—intelligences that had never controlled the mining and smelting and shaping of metal!

ZAR, tight in the clutch of those weird monstrosities, realized some of their power. Strangely it did not affect the hypnotic calm that wrapped him.

Mars. These wondrous people of the dusk of worlds had survived all animal life on the Red Planet. They had spanned Mars in a vast, irregularly formed network, growing along dry river beds, and the arms of vanished seas. They had not been mere individuals, for they had cooperated to form a civilization of a weird, bizarre sort. Great, hollow roots, buried beneath the ground, had drawn water from melting polar snows. Those roots had been like water conduits. A rhythmic pulsation within them had pumped the water across thousands of miles of desert, providing each plant along the way with moisture, even on that dying and almost dehydrated world. The canals of Mars! Yes, a great irrigation system, a great engineering feat—but out of the scope of Iorloo methods entirely.

And through the living texture of those immense joining roots, too, had doubtless flown the impulses of thoughts and commands—the essence of leadership and security. Even now, when Mars was all but dead, its final civilization must still be trying to fight on.

Strange, wonderful times those old explorers had seen. Cold sunlight on bizarre ruins, left by extinct animal folk. Thin air and arctic weather, worse than that of Earth in the present age. Death everywhere, except for those vegetative

beings grouped in immense, spiny, ribbonlike stretches. Dim shapes at night, under hurtling Phobos, the nearer moon, and Deimos, her leisurely sister. Zar did not know just how it had happened, but he had heard that only a few of those human adventurers had escaped from the people of Mars with their lives.

Zar's thoughts rambled on in a detached way that was odd for him. Per-

haps Nature had a plan that she used over and over again. On Terra the great reptiles of the Mesozoic period had died



A soft explosion of spore-pods sent powdery, choking dust of life into his face. Then Kaw watched him slump and sleep beside the alien plant.

out to be replaced by mammals. Men and the Children of Men had become supreme at last.

Succession after succession, according to some well-ordered scheme? In the desolate quiet of falling snow, tempered only by the muted murmur of the frigid wind, it was easy for Zar to fall prey to such a concept, particularly since he was held powerless in the grasp of the invaders. Tendrils, thorny, stinging tendrils, which must have been grown purposely to receive an Itorloo captive! Zar could realize, then, a little of the fantastic introspective sense which gave these beings a direct contact with the physical secrets of their forms. And in consequence a knowledge of chemistry and biology that was clearer than anything that an Itorloo might be expected to attain along similar lines.

Zar wanted to shriek, but his awe and his weakness strangled him beyond more than the utterance of a gasping sigh.

THEN the mighty spirit of his kind reasserted itself. Zar was aware that most probably he himself would presently perish; but the Itorloo, his kind, his real concern, could never lose! Not with all the mighty forces at their command! To suppose that they could be defeated by the sluggish intruders was against reason! In a matter of months—when the preparations for the vast purification process had been completed—Earth would be free of those intruders once more. Zar's brown face contracted into a leer of defiance that had a touch of real greatness. Brutality, force, cunning, and the capacity for quick action—those were the tools of the Itorloo, but they had strength too. Zar was no fool—no short-sighted individual who leaps to hasty, optimistic conclusions—but in a contest between the Itorloo and the invaders there could be but a single outcome by any standard within Zar's reach.

In this belief, he was comforted, and his luck, presently, after long hours of suffering, seemed far better than he had any reason to hope for. The hard, thorny tendrils unquestionably were relaxing from about him a very little. He could not guess why, and in consequence he suspected subtle treachery. But he could find no reason to suppose that some hidden motive was responsible.

All his avid energies were concentrated, now, on escape. He concluded that perhaps the cold had forced the slight vegetable relaxation, and he proceeded to make the best possible use of his chances. Some time during the night his straining hands reached the hilt of his knife. Not long afterward Zar clutched his blast gun.

Zar limped stiffly to his flier, cursing luridly; while behind him in the gorge, red firelight flickered, and wisps of smoke lanced into the frigid wind.

Zar wished that Kaw was somewhere in sight, to receive his wrath too. The ebon rascal had vanished.

Winter deepened during succeeding days. The Itorloo in their buried cities felt none of its rigors, however.

Zar had submitted to a physical examination after his weird adventure, and had been pronounced fit. And of all his people he seemed to toil the most conscientiously.

The Venus project. Soon the Children of Men would be masters of that youthful, sunward planet. The green plains and jungles, and the blue skies of Venus. Soon! Soon! Soon! Zar was full of dreams of adventure and brutal pleasure.

Periodically the rocket craft of the Itorloo sallied forth from the cities to stamp out the fresh growth of the invaders. The oxygen-impregnated substance of their forms flame in desert gullies, and along the rims of shrivelled salt seas, where the spore plants were trying to renew their civilization. Most of them did not get a chance, even, to

approach maturity. But because even one mature survivor could pollute the Earth with billions of spores, impossible to destroy otherwise, the purification process must be carried through.

Spring again, and then mid-summer. The spaceships were almost ready to leap Venus-ward on the great adventure. The generators, meant to spread life-destroying emanations over the crust and atmosphere above, stood finished and gleaming in the white-domed caverns that housed them.

Zar looked at the magnificent, glittering array in the spaceship construction chamber of his native community with pride and satisfaction.

"Tomorrow," he said to a companion, a fierce light in his eyes.

The other nodded, the white glare of the atomic welding furnaces lighting up his features, and betraying there a wolfish grin of pleasure.

"Tomorrow," Zar repeated, an odd sort of vagueness in his tone.

V.

KAW HAD long ago rejoined his tribe. Life, during those recent months, had been little different from what had been usual in the crow clans for thousands of years. For purposes of safety, Kaw had led his flock into a desert fastness where patrolling Itorloo fliers were seldom seen, and where only a few spore plants had yet appeared.

His first intimation that all was not well was a haunting feeling of unease, which came upon him quite suddenly one day just before noon. His body burned and prickled uncomfortably, and he felt restless. Other than these dim evidences, there was nothing to betray the invisible hand of death.

Emanations, originating in the generators of the Itorloo, far underground. But Kaw was no physicist. He knew only that he and his fellows were vaguely disturbed.

With Teka, his mate, and several of their companions, he soared high into the sky. There, for a time, he felt better. Far overhead, near the Sun's bright disc, he glimpsed the incandescent streamers of Itorloo vessels, distant in space. And presently, with little attention, he saw those vessels—there were five in the group—turn back toward Earth.

The advance in the strength of the deadly emanations was slow. Vast masses of rock, covering the upper crust of the planet in a thin shell, had to develop a kind of resonance to them before they could reach their maximum power.

By nightfall Kaw felt only slightly more uncomfortable. By the following dawn, however, he was definitely droopy and listless. The gradual, world-wide process of purification advanced, directed at the invaders, but promising destruction to the less favored native life of Earth, too.

Four days. Huddled in a pathetic group in a ruined structure of antiquity, Kaw's tribe waited. Their features were dull and ruffled, and they shivered as if with cold. Some of them uttered low, sleepy twitterings of anguish.

That evening Kaw watched the pale Moon rise from a battered window embrasure. He was too weak to stand, but rested slumped forward on his breast. His eyes were rheumy and heavy-lidded, but they still held a savage glitter of defiance, which perhaps would burn in them even after they had ceased to live and see. And Kaw's clouded mind could still hazard a guess as to the identity of the author of his woes. Brave but impotent, he could still scream a hoarse challenge inspired by a courage as deathless as the ages.

"Itorloo! Itorloo!—"

SOME TIME before the first group of spaceships, headed for Venus, had been recalled to Earth, Zar, assigned to the second group, which had not yet

entered the launching tubes, had collapsed against his instrument panels.

His affliction had come with a suddenness that was utterly abrupt. Recovering from his swoon, he found himself lying on a narrow pallet in the hospital quarters of the city. His vision was swimming and fogged, and he felt hot and cold by turns.

But he could see the silvery tuniced figure of the physician standing close to him.

"What is wrong?" he stammered. "What is it that has happened to me? A short time ago I was well!"

"Much is wrong," the physician returned quietly. "And you have not really been well for a long time. A germ disease—a type of thing which we thought our sanitation had stamped out milleniums ago—has been ravaging your brain and nerves for months! Only its insidiousness prevented it from being discovered earlier. During its incipient stages the poisons of it seem actually to stimulate mental and physical activity, giving a treacherous impression of robust health. And we know, certainly, that this disease is extremely contagious. It does not reveal itself easily, but I and others have examined many apparently healthy individuals with great care. In each there is the telltale evidence that the disease is not only present, but far advanced. Hundreds have collapsed as you have. More, surely will follow. It is my belief that the entire race has been afflicted. And the plague has a fatal look. Panic has broken out. There is a threatened failure of power and food supplies. Perhaps an antitoxin can be found—but there is so little time."

Half delirious, Zar still could grasp the meaning of the physician's words, and could understand the origin of the disease.

He began to mutter with seeming incoherence: "The changing Earth.

Reptiles. Mammals. Men— Succession. Nature—"

His voice took on a fiercer tone. "Fight, Itorloo!" he screamed. "Fight!"

Cruel, he was, as were all his people, but he had pluck. Suddenly he arose to a sitting posture on his bed. His eyes flamed. If his act represented the final dramatic gesture of all the hoary race of man, still it was magnificent. Nor were any tears to be shed, for extinction meant only a task completed.

"Fight!" he shouted again, as if addressing a limitless multitude. "Fight, Itorloo! Study! Learn! Work! It is the only hope! Keep power flowing in the purification generators if you can. The old records of the explorations of Mars—those plants! Their approach to problems is different from our own. No metals. No machines as we know them. But in hidden compartments in their tissues it was easy for them to create the bacteria of death! They *invented* those bacteria, and grew them, breaking them away from their own substance. Some way, when I was a captive, I was infected. The thorns on the tendrils that held me! I was the carrier! Find an antitoxin to fight the plague, Itorloo! Work—"

VI.

ONE YEAR. Two. Three. The sunshine was brilliant, the air almost warm. The rusty desert hills in the distance were the same. Ancient ruins brooded in the stillness, as they had for so long. On the slopes ant hordes were busy. Rodent colonies showed similar evidence of population. In the sky, Kaw and his companions wheeled and turned lazily.

This was the same Earth, with several changes. Bulbous, spiny things peopled the gorges, and were probing out across the desert, slowly building—with hollow, connecting roots—the wa-

ter pipes of a tremendous irrigation system. Like that of Mars, and like that of Ganymede, moon of Jupiter, in former ages. Saline remnants of seas and polar snows could alike provide the needed moisture.

Thoughts traveled swiftly along connecting roots. Little orbs and wicked spines gleamed. The invaders were at peace now. Only the Itorloo could have threatened their massed might. There was no danger in the lesser native life.

The subterranean cities of the former rulers of Earth were inhabited only by corpses and by intruding ants, who, like the other fauna of this planet, were immune to the plague, which had been directed and designed for the Itorloo alone. The last race of men was now one with the reptiles of the Mesozoic. But all was peace.

Kaw screamed out his contentment in loud, lazy cries, as he circled in the clear air. He seldom thought of the past any more. If the new masters were not truly benignant, they were indifferent. They left him alone. Kaw, creature of Earth's dusk, was happy.

The great surface dome where Zar, the Itorloo, had once kept watch, was already surrounded by crowded growths. The plants had achieved a great, but an empty, victory. For Earth was a dying planet. Within the dome an astronomical telescope gleamed dully, collecting dust. Often Zar had directed it toward Venus, goal of shattered Itorloo dreams.

But who knew? Out of the void to Ganymede the invaders had come. Across space to Mars. Riding light to Earth. Perhaps when the time came—when Venus was growing old—

MONSTROUS TWIN

SULPHUR and selenium are twin elements, closely similar—to the inorganic chemist. But to the organic chemist, the biochemist, the resemblance practically ceases. Selenium is poisonous, horribly poisonous in a genuinely loathsome manner. There is sulphur in eggs, of course. That sulphur is there because, for some yet-unknown reason, sulphur is vital to growth processes. Evil-smelling thio-glycerine (glycerine containing a sulphur atom in place of one or more of the usual oxygen atoms in the molecule) is used on burn-dressings because the sulphur somehow, mysteriously, promotes the growth of new tissue and swift healing. Hair contains a large proportion of a sulphur-containing protein material.

IN certain regions of the West, the ground is poor in sulphur. Plants growing there, unable to get the badly-needed sulphur, take the near-twin element, selenium, instead.

THEN the deadliness of the element begins. Cattle and horses, chickens and similar animals eat those plants. Their growing cells require sulphur, and the selenium slips in instead. Hair-cells, trying to manufacture that sulphur-containing protein, first find that the substitute won't work. The hair-cells are poisoned, die, and ulcerous sores appear. The hair drops out in ugly patches. Sores, cuts, bruises fail to heal, as the growth-stimulating functions of the tissues fail for lack of sulphur. The wounds spread and fester. The animal's brain is affected.

BUT selenium-fed hens laying eggs somehow manage to get the selenium into the proteins that should contain sulphur. And it works—somewhat. The things that hatch out live, for a while at least. But they aren't chickens. They are monstrous things. Growth of young, new cells—where sulphur is most vitally needed—goes on somehow—but it goes *wrong*. Calves and colts born to cattle and horses fed on that poisoned fodder are monstrous, the degree of wrongness increasing with the proportion of selenium the mother animal ate.



A golden cloud of them swarmed up from the tiny buildings, factories and mines.

Isle of the Golden Swarm

by Norman L. Knight

The empire that did not want to be known

McGRATH came aboard the ship at Port Said, in the middle of an afternoon of withering heat. Two swarthy, white-turbaned men carried him up the gangplank and into his

cabin; his legs dangled inertly as if paralyzed. They passed within a few feet of my deck-chair, where I lay baking and sweltering in the shade of an awning. McGrath's appearance shocked

me out of a semi-stupor and into a state of observant wakefulness.

He seemed a youngish man, and yet he was extraordinarily emaciated. His hands were bony talons resting on the shoulders of the two porters. His clothes hung and flapped loosely upon him. Half of one ear was missing, and the tip of his nose had been sliced off obliquely. The scars were dark red, and obviously recent. His face was the thinly masked face of a skull, the eyes retracted into cavernous sockets and haunted by the shadow of some abysmal fear.

I did not see him again until several days later, after we had passed Gibraltar and were well out upon the Atlantic. (The ship was a freighter, the *Eastern Dart*, carrying passengers incidentally, and had put in at both Palermo and Algiers after leaving Port Said.) It was one of those days when the sea is an incredible blue, flecked with restless streaks of luminous white, and the ship rolled but slightly. McGrath appeared on deck hobbling on crutches, and a steward assisted him to the deck-chair next to mine. Seen thus closely, his features were scarred by a number of small pits, like miniature pock-marks. His eyes were bloodshot. He answered my greeting absently, then became absorbed in silent brooding. And it was a plutosophical idea he tried to present.

When at last he spoke he was somewhat incoherent.

"A really new idea is a fearful thing to most people," he remarked abruptly. "Their minds resist it—go on the defensive—instinctively. The idea of a round earth—and still worse, a moving earth—seemed a wanton insult to the human intelligence. And organic evolution—well, many a mind is outraged even now, at the bare thought of it. We absorb new knowledge slowly. Perhaps it is just as well. If our knowledge increased at unlimited speed, if we accepted new facts immediately, could we

endure it? If, by some miracle, a human mind could suddenly see and comprehend everything—the whole world—all the hidden things, all the inhumanly strange things— Might it not disintegrate like—like the burning-out of a fuse in an overloaded circuit?"

He paused and seemed embarrassed. He smiled and shook his head.

"I'm not really unbalanced," he assured me apologetically, "although sometimes I may talk as if I were. But I have had a disturbing experience, a profoundly disturbing experience. If only I could tell someone about it without feeling that I might raise doubts as to my sanity— Sometimes I doubt it myself."

Since it was evident that he was harassed by some queer, emotional stress and felt that he could unburden himself by talking, I encouraged McGrath to continue. It was at this time that I learned his name—Finley McGrath—and thereupon recalled that it was a name which appeared periodically on the picture-pages of newspapers. He was always returning from some remote portion of the globe with a trunkful of photographs and motion-picture films. He explained that he had a large—and, he felt, undeserved—income. He was unmarried, had no close relatives, and so indulged a passion for exploration.

HE BEGAN his career as a mere aimless traveler, but soon found himself more and more intrigued by the seemingly infinite variety of human types which he encountered than by the stereotyped "points of interest" for tourists. The more primitive races particularly excited his curiosity. Inadvertently, so to speak, he became an amateur anthropologist. From an interest in primitive races he passed to an interest in prehistoric man and the controversy regarding the place of the origin of the human race. Was Asia or Africa the "cradle of humanity"? Or had two

kinds of humanity appeared in each, at different times?

McGrath decided to take Africa as the field of his researches, and made at least one noteworthy contribution to the prehistory of man on the Dark Continent. Probably the reader will recall the flurry of popular excitement in 1946, following McGrath's discovery of the almost complete fossil skeleton of an immature male creature now known to science as Uganda Man, *Australopithecus ugandensis*, but hailed for a few brief days of notoriety by press and radio as "the African Gorilla Boy".

In the course of his African explorations which culminated in the discovery of Uganda Man, McGrath became intimately acquainted with several communities of those curious little folk, the pygmies, who are indispensable as guides in certain regions. Moreover, his movements frequently took him through the gorilla country and he was seized with a desire to know more of these huge, manlike forest dwellers. He was quite free to change the subject of his investigations, since the latter were conceived and financed entirely by himself. The net result of these circumstances was that McGrath undertook to study the gorilla at close range in its natural habitat.

"At first, I tried to find out all that was known about gorillas," said McGrath. "I read all the books I could get, corresponded with various people, interviewed others. And I was astounded when I found that the gorilla is, as it were, an unknown animal. I mean that next to nothing is known about it. Oh, we know its anatomy, of course, and something of the behavior of young individuals in solitary captivity. And a few people have taken unsatisfactory movies of gorillas, or have watched them with binoculars for a few hours, in their native forests. They are vegetarians, and go about in troops, usually small—a big male, his harem,

and their young. They make beds of leaves on the ground at night, less often in trees. They are scarcely any more arboreal than man. And their ferocity is largely a myth. They are aggressive when annoyed, or when the old male becomes alarmed for the safety of his family. That roughly sums up the information I could gather.

"I felt baffled; I couldn't believe it at first. It had seemed to me that such a near-human creature—a being whose behavior might shed light on the prehistoric childhood of our race—would have been the object of the most intensive study as soon as it was realized that man is really a sort of sublimated ape."

"And did you devise some way of observing gorillas, more effective than previous methods?" I inquired.

"It's perfectly obvious how it should be done," replied McGrath in a faintly surprised tone, as if a description of his method should have been unnecessary. "How does one study a primitive human race? One goes among them and lives with them until they are accustomed to one's presence. Then they will behave naturally even when one is with them and watching them. I applied the same technique to gorillas."

"You mean that you camped somewhere in a gorilla forest and then waited to see what the gorillas would do?"

"I didn't wait passively; I did things to attract and interest them. And I had a sort of camp, but it wasn't a tent. I was afraid that a tent or hut would look strange, and make the apes unduly suspicious. So I lived in a cave which I fixed up, alone, for six months."

"Hold on!" I exclaimed. "You were alone? Why alone? Wasn't that taking a big risk?"

"I felt that the fewer people there were about, the better were my chances of success," McGrath informed me calmly. "Besides, I didn't know of anyone on whom I could depend to behave in accordance with my plans. I didn't

want to risk having a jittery partner who might fire a gun, or fly off the handle in some other way, and so destroy the carefully cultivated confidence of the gorillas after months of effort. And it reduced the list of necessary supplies. It was a risk, of course. When I got my permit to enter the gorilla country, from the Belgian government, I didn't tell them my plans in full. The permit might have been refused. The Belgians endeavor to restrain amateur explorers from rash enterprises, as well as to protect the gorillas from unscrupulous hunters. If I had broken a leg, or had come down with an attack of appendicitis during those six months, I would have been in a bad way. As it was, I barely got out alive."

"Then some unforeseen mishap did occur!"

"Unforeseen mishap! Lord, yes!"

"Did an evil-tempered gorilla catch you unawares?"

"THE THING which happened to me was not due to the malice of a gorilla nor to any human agency," declared McGrath, with a queer look. "I was harmed by neither fish, flesh, nor fowl. And I have yet to encounter an evil-tempered gorilla—although I am told by reliable authorities that solitary outcast 'rogues' do exist. As a matter of fact, I owe my life to a gorilla."

"No! How was that?"

"He carried me bodily out of a very bad predicament after the—the accident happened. I called him Gunga Din, even before then. But I'll come to that shortly. Where was I?"

"You said that you fixed up some sort of cave dwelling, alone."

"I said that I stayed there alone for six months—alone, that is, so far as human companionship was concerned. But Kwanga and his 'boys' helped me to find the cave and carried in my supplies—one hundred odd miles through incredi-

bly rough country—on their heads, and helped me to get settled in the cave. Kwanga is a Batwa, a pygmy of the Batwa tribe, and a swell fellow. I owe a lot to Kwanga. A chance remark of his led me to the discovery of Uganda Man.

"It took almost a month to traverse the slightly more than one hundred miles from Kwanga's village to my cave. The pygmies could have made it much sooner, but I delayed them. I have traveled afoot over some rough terrain at various times, but this trip was in a class by itself. The whole country has been shattered by an ancient upheaval and is densely overgrown—with subtropical and temperate types of forest, because of the great altitude. We averaged about four miles per day, measured on the level. But that doesn't include the ups and downs. Sometimes we went up eight hundred or a thousand feet and then down again, three or four times during the day's journey. And there were thickets of giant grass—like cornstalks—woven together in a three-dimensional mat, full of monkey-tunnels. Patches of giant nettles that even the elephants went around.

"The Batwa scrambled over and around all these obstacles, up hill and down dale, chattering and making a lark of the whole thing. They adopted an indulgent, paternal attitude toward me, as if I were a child attempting a too-difficult task. The end of each day found me more and more exhausted. Finally Kwanga discovered the cave one afternoon. It looked like a good spot, and we had been seeing or hearing gorillas frequently, so we stopped there.

"Kwanga's 'boys' walled up the cave-mouth for me, leaving a waist-high entrance which could be closed from the inside by rolling a boulder in front of it. I instructed Kwanga to return in six months—after the next rains—with certain supplies, and then they left me.

"But before he departed Kwanga said

a curious thing. 'If the Picture-Box Master is wise'—that was their name for me, inspired by my camera—'If the Picture-Box Master is wise,' Kwanga



said, 'he will not go far beyond this place. Beyond here the forest is not good to be in. There are little demons flying in the air. Men who go there do not come back. Kwanga tells you a very big truth.'

"One wouldn't accept such warning literally, of course. I told Kwanga that I would remember what he had said, but secretly I believed that the remoter forest was inhabited by some species of bat or bird of grotesque form or coloring, possibly nocturnal, and perhaps possessed of a voice that was unusually loud or in some way uncanny. The men who didn't come back, I thought, simply were victims of ordinary accidents such as might easily befall them in that kind of country."

A near-by cabin door was opened at this point by one of the ship's passengers. There was a radio in the cabin and it had been left turned on. It was emitting a loud droning buzz, which stopped with a click. Then the door closed. McGrath's face turned a sickly

yellow and he clutched the arms of his deck chair.

"My self-control is all shot," he remarked shakily. "A sound like that—startles me more than you can imagine."

He was silent for a few minutes and his features gradually regained their normal hue.

"It may seem strange to you," he continued, "but after the Batwa left me I felt myself enveloped by a vast peace and serenity. I was in the heart of a forest that seemed as old as time. The very air smelled ancient. And yet there was nothing oppressive in that atmosphere of immense antiquity. The giant trees seemed to exhale an all-pervading, soothing silence—a shadowy, mossy, fern-draped stillness. The sounds of birds and insects, the distant guttural bark of gorillas, merely accentuated the stillness."

McGRATH now embarked on a description of how he aroused the interest of his gorilla neighbors, gradually won their confidence, even succeeded in laying hands on them with impunity. A grizzled patriarch minus one eye was the first to be won over, finally succumbing to the attraction of salted peanuts. It was a sufficiently astounding story in itself, but the details are not relevant to this narrative. He came at last to the case of the young male anthropoid whom he eventually christened Gunga Din.

"The same day that I moved the salt-lick to within twenty paces of the cave and old One-Eye snatched my breakfast," McGrath went on, "I noticed a band of four young bucks spying on me from the thicket of wild celery. Gunga Din was one of these four. They were mature youngsters who had been forcibly ejected from their respective families by the jealous Old Man gorillas, when they became unduly attentive to members of the harem. They had not yet

found mates, and so had drifted together into a fraternity of forlorn bachelorhood. I got out the tom-tom and gave them the rhythm test.

"Gunga Din reacted emphatically. He set up an answering rhythm of coughs, *Waugh! Waugh! Waugh!* For some reason, this angered the other three and they all cuffed him unmercifully. Gunga Din did not retaliate, but

fled, bellowing angrily. Subsequent happenings amply proved that he was no coward; he merely disliked to quarrel.

"In fact, Gunga Din was a somewhat superior gorilla, and an emotional misfit in his community. He returned day after day to the salt-lick, and gradually came nearer and nearer to enjoy my tom-tom serenades. The other three bachelors disappeared to be seen no



"Whenever I tried to get into that part of the forest, Gunga Din stopped me—and there was no arguing with that arm of his."

more. At length Gunga Din would permit me to scratch his back with a stiff brush. Then he began making his nest of leaves at my cave door every evening. He came into the cave once, but frightened himself by upsetting a pile of aluminum utensils and would not enter again.

"I gave him a tambourine and he wrecked it in half an hour. Then I gave him a cow-bell attached to a loop of light rope for carrying, and he took it everywhere. No matter where Gunga Din wandered in the adjacent forest, I could tell approximately where he was by the clanking of his bell.

"He developed an infected tick-bite on his arm, which I treated and cured, and he became even more a doglike companion—and protector—than he had been before.

"Frequently we went places together. The gorillas had made tunnellike trails through the undergrowth, and I explored miles of them, accompanied by Gunga Din. I carried a gun, but I had resolved never to use it except in the last extremity of danger, and did not fire it once during the entire period of six months I was there.

"And I discovered an odd fact. When I followed the tunnel-trails in the direction of Kwanga's 'haunted forest', they invariably came to a dead end or turned aside. This gave me to think, as the French say. And if I endeavored to press on into this apparently taboo region, Gunga Din would clamp an enormous black paw around my arm and toss me back along the trail in the way he knew I should go. At such times I felt that my experiment was proving a bit too successful. There was no arguing with that arm of his.

"Then a solitary young female began to haunt the vicinity of my cave, and Gunga Din discovered a new interest in life. (It seems that the Old Man's daughters run away when they become mature, but they don't band together

like the young bachelors. There's a point for our psychologists to reflect upon.) She and Gunga Din went through an elaborate performance of indifference. They would roam the neighboring forest for hours, always within sight of each other, but studiously ignoring each other.

"THIS GAVE ME the opportunity for which I had been waiting. One fine morning when Gunga Din's cow-bell was almost inaudible in the other direction, I set out toward the *verboden* part of the forest. I penetrated about a mile beyond a dead-end trail and came out into a zone nearly free of underbrush. The ground was thick with golden-brown moss, and graybeard pennants hung from huge trees with massive trunks of pallid gray. And the silence was not the silence which surrounded my cave. It was not simply the eternal background for the familiar, pleasing forest sounds. It was a tense, uncanny silence. Not a bird, not an insect.

"Then I saw the pygmy's skeleton, partly embedded in the moss and stained green with algæ. It was in excellent condition. None of the bones were crushed, chipped, or broken. They had simply fallen apart at the articulations. A smooth, round hole had been drilled through the temple of the skull—otherwise it was intact. I looked for a bullet in the brain cavity, but there was none to find.

"As I stood pondering over this, I heard the clanking approach of Gunga's bell. It jangled as if it were moving in great leaps. I laughed between amusement and vexation, suddenly realizing the extent to which our relations had altered. Gunga Din had remembered his problem child and was coming to see what I was doing. He was assuming the role of protector and disciplinarian; I was his wayward protege, perversely attempting to do the forbidden at the first opportunity.

"Gunga Din appeared bounding toward me over the mossy turf among the farther trees. As he drew near I was alarmed, thinking that he meant to do me violence. His eyes were popping out of their sockets and his teeth were bared. I know now that he was horribly frightened. The next moment he had tucked me under his arm like a bundle of old clothes and was loping back whence he came. He did not put me down or cease running until we were in front of my cave. Then he dropped me, and I had no sooner scrambled, spluttering, to my feet than he administered a tremendous cuff over the side of my head with the palm of his hand. I presume that it was intended only as a gentle admonition, but to me—poor human weakling—it was like being clouted with a blackjack. I went down for the count. When I regained consciousness he was rolling about on the ground, wailing dolefully, evidently laboring under the not-very-false impression that I was dead.

"It was after this episode that I began calling him Gunga Din.

"A little later he deserted me. He and the young female had reached a stage where they no longer ignored each other, but behaved as if each were merely tolerating the other. Certain incidents which I happened to see revealed that the lady objected to Gunga Din's cowbell. He had to make up his mind to renounce either one or the other of them. He must have undergone a painful internal struggle for a time. Then one morning when I crawled out of my cave, there was no Gunga Din. But lying in his nest of leaves was the cowbell, polished smooth and black by much handling, attached to the frayed loop of rope. I hung it on a rocky projection by the cave. I felt certain then that Gunga Din probably would not return until after many days, if at all.

"To my chagrin, the rains chose to begin at this time, so my plans for in-

vestigating the haunted forest were necessarily postponed. Every valley resounded with the turbulent seething of impassable streams.

"BUT ALL THINGS must cease, even the rains. Came a day when I set out through a rejuvenated forest, brilliant with new greenery and a riotous profusion of flowers. My enterprise quickly ran into difficulties. The open forest, where I had found the pygmy's skeleton, soon came to an end. I spent a week hacking a path through a tangle of shrubs and creepers, returning to the task each day. I had to go through—I could find no way around. I stumbled on two more skeletons in this tangle, one of a leopard, the other of a half-grown gorilla. They were old bones, with shrubs growing up among them. In both cases the skulls had a single perforation through the temple. There were spiral marks around the inside of these holes, as if something had drilled through with a whirling motion.

"I spent more days looking for a way around or through a patch of giant nettles which must have extended over several square miles. Beyond this was open, moss-carpeted forest again. And over it all hung a menacing silence; there was no sound save the occasional rush of the wind in the leaves.

"Having blazed a trail thus far, I set out from my cave early one morning with two days' provisions, my gun, binoculars, and a miniature movie camera. It required only about six hours to follow my marked trail to the place where there was an open lane through the nettle patch. From there on, the going was easy. The terrain was nearly level and I trod on soft moss through the forest shade.

"I encountered skeletons with ominous frequency. The farther I went, the more there were. In one place were the skeletons of three buffalo; in an-

other, the bony remains of an indefinite number of baboons were strewn over a large area. And in every case the skulls were perforated by a single hole in the temple, *but there were no bullets in them.* I tried not to think of Kwanga's warning, and told myself that perhaps after all there might be some truth in the tale—which I had rejected as mythical—that wild beasts have 'graveyards' where they go to die.

"Late in the afternoon I heard a sound—a steady drone like the motor of an airplane. And it came from above. I ran this way and that, looking upward, but the roof of foliage was impenetrable. The droning grew, passed by, and faded in the distance. I decided that it might have been a Belgian plane making a photographic survey."

McGrath paused and appeared to brace himself as for an ordeal.

"About a mile farther along, I came to the lake, approaching it down a gentle slope through a veritable valley of bones. The shores of the lake were littered with them. Rising from among them I saw the great white dome and curving tusks of an elephant's skull.

"In the center of the lake was a wooded islet. A grayish mass of curiously pitted rock rose from the midst of the trees, and it gleamed and sparkled under the declining sun as if from the outcroppings of bright metallic minerals. Wisps of smoke or steam rose at several points along the rocky shores of the islet, which I took to indicate the presence of hot springs or volcanic vents. I filmed the islet and the shores of the lake—then turned my binoculars upon the former.

"The object which I had thought to be a mass of pitted rock was an artificial structure. It was full of little window-openings, and had metal fittings and ornaments. The wisps of smoke—well, you won't believe me."

"Go on," I urged.

"ALONG the shores of the islet were several groups of buildings of toylike proportions. I could gauge their smallness by the relative size of the trees. Their architecture was—like nothing else on Earth. But they were enough like similar structures of human origin for me to divine their purposes. They were miniature mines and foundries, running full blast."

"Why do you say 'of human origin'?" I demanded. "Weren't these things of human origin? I was expecting you to say that you had discovered a community of civilized pygmies."

"You don't understand," replied McGrath. "These structures were much too small for that. They were like doll houses. The inhabitants—were not human!"

"Not human!" was all that I could exclaim, then stared speechlessly at McGrath.

"You think I'm mad!" he cried, wiping the perspiration from his forehead with a shaking, bony hand. "But I'm telling you the gospel truth, so help me! While I gazed through my binoculars in amazement, a sparkling swarm of creatures issued from the structure in the center of the islet. My first thought was that they were small birds with metallic golden plumage. Then they formed themselves into ranks and squadrons in the air and arrowed toward me. They came with a sinister zooming rush—like the sound of a distant airplane.

"One lens of my binoculars clicked and cracked as some small missile struck it, and my face and arms felt as if they had been pricked by a score of red-hot needles. Hurriedly dropping the glasses, I saw a number of little steel darts, like phonograph needles, sticking in my arms. I plucked them out, and some others that were embedded in my face. But already a fiery sensation of burning and prickling was radiating with

terrible swiftness from each puncture. It suffused me from head to foot. Then came a numbness and dizziness. My legs folded under me, and I rolled among the clattering bones. I endeavored to rise and found to my horror that I



could not stir so much as a finger. Only my involuntary muscles—heart, diaphragm, eyelids—continued to function.

"I had fallen with my face toward the lake. Unable to move, unable to cry out, I watched the golden swarm from the islet swooping down upon me. The creatures descended in disciplined formation, alighted upon me and around me.

"They were insects! They were giant hornets, the size of humming birds, and their bodies and limbs seemed wrought of burnished gold. They walked upon their two hinder pairs of limbs, but held the fore part of their bodies upright, in the manner of a praying mantis, and were very dexterous with their third and forward pair of limbs. The first squadron to arrive was armed with little crossbows of silvery metal.

"The next contingent carried an armament of straight, curved, and hook-pointed blades. They did not run about in the nervous, aimless fashion of ordinary wasps, but moved with orderly, purposeful swiftness. A half-dozen of them trotted over me in an exploratory fashion, seemed to confer, then amputated a bit of my nose. The operation

was painless; the venom of their darts must have been an efficient local anesthetic as well. They immediately applied a styptic paste to the wound. Then they retired with the fragment to a point just on the edge of my range of vision, where I could not see exactly what they were doing. But my impression was that they—devoured it!

"The blade-bearers then swarmed over me and commenced cutting away my boots and clothing in small bits. They had triangular faces and bulging, red-gold eyes. Horrible half-formed thoughts darted through my mind. I thought of the wasps who paralyze spiders with their stings and entomb them with the eggs, to be eaten, living but immobile, by their larval young. But the skeletons I had seen had been stripped, apparently, where they lay. And every skull had a hole drilled through the temple! I thought of a trip I had once made through a great abattoir in Chicago. I felt my sanity slipping."

"But you say that you saw the remains of elephants, and of buffalo," I objected. "How could steel darts the size of phonograph needles, shot from tiny crossbows, penetrate the hides of such animals?"

"THEY HAD other weapons," said McGrath grimly. "They had their heavy artillery as well. While my clothing was being removed piecemeal, a sort of ship put out from the islet. It was rather like a small-scale working model of a modern battleship, about fifteen feet in length. It cleft the water with a smooth purring, and there was no sign of smoke or steam. It came about close to shore, and the crew let down a gang-plank. A number of little machines then came ashore, traveling on caterpillar treads and whirring like mechanical toys. One of them was certainly a drilling machine—the diamond-bright drill was very prominent—and one of them

was probably a kind of pump. The others were mysteries.

"And on the deck of the ship was ranged the heavy artillery I spoke of. There were batteries of steel catapults on mobile mounts. I could see the slender needle-pointed projectiles lying in their grooves."

"I might believe your story, except for one circumstance," I observed. "Frankly, I think that you are a writer of bizarre fiction and are merely testing your latest inspiration on me to get my reaction. If such a race of highly intelligent creatures really exists, why should they remain hidden in their fastness, unknown to the world? Would they not emerge to explore and observe? Would they have no dreams of conquest and expansion?"

McGrath fixed an austere, bloodshot eye upon me. I thought of the Ancient Mariner.

"Why did Europe have to wait until after 1492 to colonize the New World effectively?" he demanded. "It was a possibility long before that, as the Vikings demonstrated. The obstacles were mental and emotional, not physical. But I think that the real answer to your question is this: The people of the Golden Swarm are wiser than men; they do not dream of conquest. And how do we know that they have not frequently emerged to explore and observe, as you say? Being the intelligent creatures that they are, would they not carry on their expeditions into the outside world very discreetly? Would they not quickly realize that our race is overwhelmingly more numerous and powerful than theirs? Would they not consider it highly desirable to remain unknown, and approach our large centers of population with great caution? Even if a number of them did fly over a large city at an altitude of five hundred feet, let us say, who would notice them? They are smaller than sparrows. Like certain 'rare species' of moths which

are suspected of being much more plentiful than they seem to be, the members of the Golden Swarm may be adepts at keeping out of sight. If a score of them alighted on the summit of Eiffel Tower, who would observe them?

"And if someone did, and reported it, who would believe him? Imagine what the reaction of the public would be to a headline like this: 'Window Washer Sees Wonder Wasps Roosting on Radio City'. Or, 'Monster Insects Panic Penthouse Party'. What would be your comment? I repeat: For the promotion of our peace of mind and continued sanity, we absorb new knowledge very slowly."

"You put up a plausible defense for a fantastic thesis," I admitted. "At any rate, go on."

"When my captors had reduced my clothing to a mass of tatters," McGrath resumed, "a delegation of hornets of a different sort appeared on the scene. They had bigger heads than the others—hammer-shaped—about the shape and size of a pecan nut, with an eye in either extremity. All work stopped while they examined me. Then they found my camera and gun lying among the bones, and became greatly agitated. Miniature tractors, whirring busily, dragged



these articles to the water's edge, whence the ship took them aboard with a crane. They did likewise with the binoculars and various things which had been removed from my pockets.

"By this time, twilight was upon us. The tractors and some other mobile mechanisms returned into the ship. Others were left near me, hooded with translucent coverings. The horde of workers took wing in military formation, and the ship purred quietly across the water to its island harbor. It seemed taken for granted that my paralysis would continue undiminished until the carnivorous swarm returned to begin their dissecting operations next morning.

"DARKNESS fell, and the islet suddenly twinkled with a thousand pinpoint lights which flashed on in groups—one after another—as if somewhere a series of electric switches had been thrown. I could not be sure, but it seemed that a faint peal of little chimes came drifting across the lake, like the tinkling of a toy piano. Then after a time, the lights blinked out, and I lay in almost complete darkness.

"A scarlet glow centered around each of the Lilliputian foundries on the islet, and I could see the quivering reflections of stars in the lake. I could not turn my head to look up. The wind rustled in the blackness of the all-encompassing forest. I felt no physical pain—I could not feel the bones I lay upon. I might just as well have been a wooden image. But the mental torment—! You cannot imagine the agony—lying helpless, moveless, silent—feeling that I was lost in the midst of a vast, dark, empty indifference—awaiting a fate which I did not dare to imagine—

"But I was not lost. After the passage of an immeasurable abyss of time, I heard a tiny sound in the night—a metallic tinkle, infinitely remote. At first I thought that it came from the island, and was the precursor of dawn. But it came from the forest behind me. It came nearer. It was the clank of Gunga's cow-bell.

"Why he had returned to the cave, how he sensed whither I had gone, why

he brought the bell with him, I can only guess. Perhaps in some obscure way the familiar clangor of the bell gave him courage.

"Gunga Din came stumbling toward me with a clacking and rattling of disturbed bones. He breathed in great whistling gasps of fear. Then he touched me, rolled me over on my back, stooped and sniffed at my nostrils. I could see his squat, neckless shape silhouetted against the stars. Fantastic situation! To any other human being, under any other conditions, he would have been a terrifying sight. To me he was an angel of deliverance, and that bell was a golden harp.

"Either the members of the Golden Swarm have very poor hearing, or they do not fly by night under any circumstances. Whatever the reason, the clank of the bell did not rouse them. Gunga Din threw me over his shoulder as if I were a sack of meal and commenced the return journey. One of my ears lay against his hairy back, and I could hear his massive heart chugging and pounding with terror.

"To my distraught brain that return was like a lunatic's dream. Imagine it! Hanging limply over the shoulder of a shaggy ape, fleeing in the dead of night through the blackness of an ancient forest, to the accompaniment of a clanking cow-bell!

"It was broad daylight when we arrived at the cave. Kwanga and his troop of porters had arrived with my supplies—now useless to me—as we had arranged six months before. They were squatting in a circle before my cave, looking very sorrowful, but leaped to their feet with shouts of amazement when Gunga Din dropped me at the edge of the forest and fled.

"There is not much to tell after that. Eventually I was brought to a hospital in Mombasa. The paralysis began to disappear slowly. If I hadn't been so

prompt in plucking out the darts—but why think of that? I started home, then had a nervous breakdown just before we reached Port Said. I was—well, psychopathic. I had the Horrors. They put me off the ship there, and into another hospital. It took me three months to get into condition to travel again.”

“If you had something tangible, some material evidence, to support your statements,” I remarked, “they would be much more credible.”

“Material evidence!” McGrath exploded. “Look at me! I’m Exhibit A! What more do you want?”

Then he checked himself.

“No, you’re right,” he sighed. “I might be just an eccentric invalid. Well—look at this. It isn’t much, but it’s all that I have in the way of proof. Kwanga found them in the remnants of my clothes.”

McGrath produced a silver cigarette case from his coat pocket, opened it, and displayed several small objects on a bed of cotton. Of course, the things like phonograph needles may have been only that. But they were peculiar in being minutely perforated and channeled near their points. And the cotton round about where each needle lay was faintly tinted with yellow. The two remaining objects were well within the range of the abilities of Oriental craftsmen skilled in the making of tiny ornaments. I have seen ivory carvings much more minute and intricate. And yet—these things were of metal and had the trim, severe lines of machine-made articles.

One of the objects was a cutlass about one inch in length, with a delicately corrugated handle of gun-metal gray. The other was a miniature chromium cross-bow, powered by springs of blue steel.

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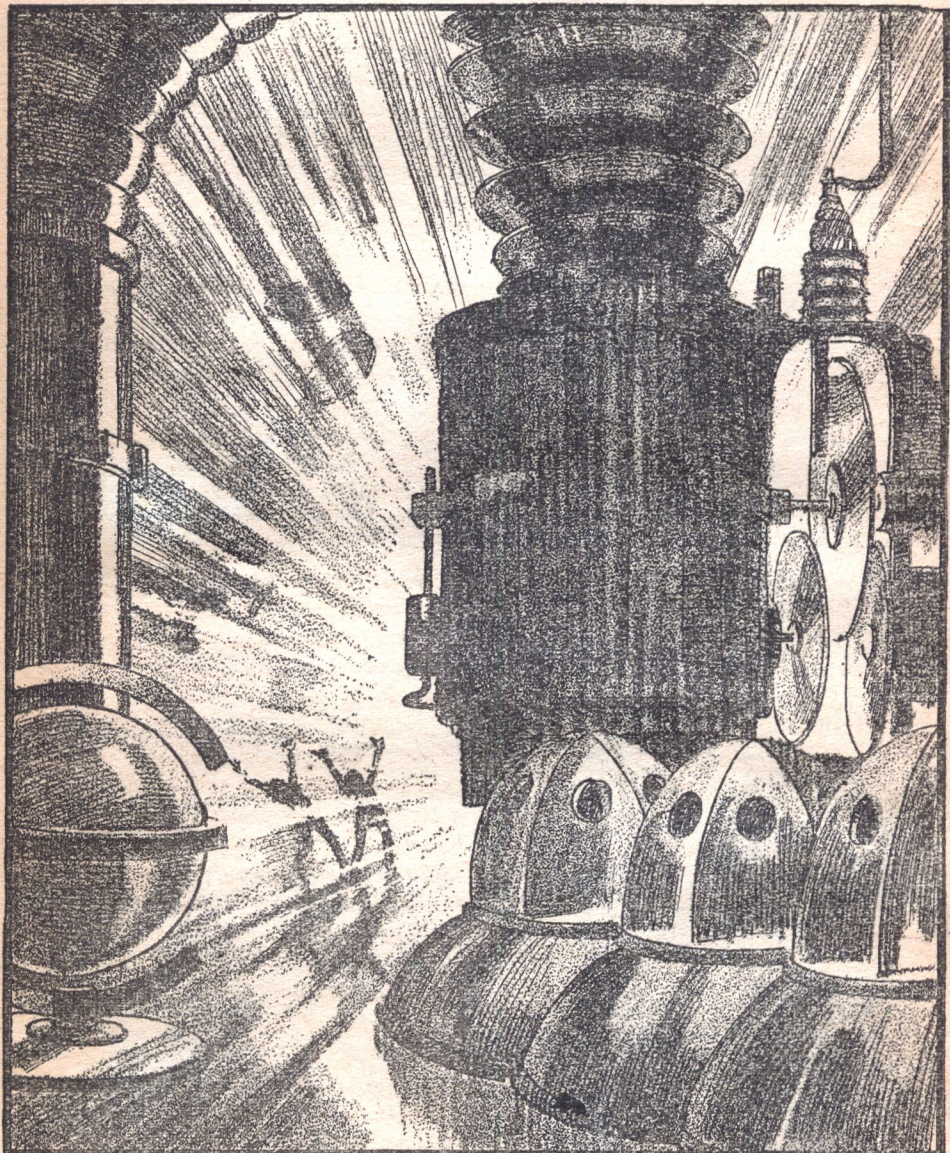
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SYNOPSIS OF PART II.

TWO dynamic and diametrically opposed men ruled the two worlds which constituted civilization on Earth. Vincent Drega, who had come up from a boss contractor to the financial power behind governments and empires, was still a builder at heart. He was intensely human, and intensely conscious of human weaknesses. He took the world as it was and made the most of it.

Simon Gamble was the greatest electronic scientist of all times, a genius whose thoughts ran to idealistic, scientific perfection. He thought of MAN—not of men.

Inevitably the two were to clash. The clash came when Gamble proposed to produce gold at the price of copper, and grow wheat for a cent per bushel. It would save Mankind, he said.

Drega was appalled. No progress was worth the cost of a shattered economic system. He realized that the greatest of all resources of Earth was the economic system which made all other resources available.

The two men quarreled and parted. Gamble made public what he would do. Markets crashed, factories closed, industry came to a standstill. The poor, the underpaid laborers, the very men he had wanted to help, turned bitterly against him. His mere announcement nearly broke the System that fed them.

Gamble, seeking perfection in the world, saw that the economic system—traditions—habits—were his enemies.

Only a complete break with those traditions would enable man to shake off the shackles of centuries of thought-habit and take up progress in a detached light of pure values. Ten years after his quarrel with Drega, he threw mankind into suspended animation.

Three thousand years later, Man awoke. Life in bodies had merely been asleep. But life on Earth had gone on. Time had wrecked the world.

Without question, Drega took matters in hand. Men had nothing left to build with or live by but bare hands. All else had been destroyed. He established trade and wages and the profit motive. He had Manhattan—the ruins that had been the City of New York—surveyed. He fought with savage, starving, cannibal tribes, and organized the interests of his clan.

But his methods were the old methods, the human methods.

His clan had food enough—but no more. They were building. Slowly, they were forming a crude basis of civilization as it had been. Drega saw the hopelessness of taking expert technicians and trying to achieve former civilization overnight. First was the important item of Man's very existence, and then the slow beginning from crude implements and manual labor.

Into this toolless, foodless, clothesless dawn of a reborn civilization came Simon Gamble with all the equipment and paraphernalia of his advanced science laboratory. In perfect condition, his private labs had been protected by a shielding atmosphere of pure hydrogen.

A battle between two systems ensued. Drega was unable to offer the necessities of life beyond his ability to organize and make men work with the tools and power and resources at hand. Gamble offered immediate sustenance, assurance of food and heat and clothing. But more, he offered the highly trained and specialized technicians the tools with which they were familiar, and a world without the money—the economics—he hated.

There was not room in the new civilization for compromise with the old barter and trade and profit systems, or compromise with the new perfection science. One had to go.

Drega left, taking a bare handful of loyal men of all the thousands he had saved. It was not an easy choice for the men who followed Drega. Ahead of them lay a wilderness, no conveniences of civilization, an almost primeval land to strip from the roots up. Behind them lay the basic security of Gamble's world. But they did not trust that basic security, that order and regimentation which left no room for compromise, no room for inbred traditions, no room for human error.

Gamble suddenly remembered the clan's extreme emaciation and privation. There would be a feast. But he had not brought much food from the laboratory. He brought out a small watch-sized gadget, a highly advanced radio transmission set, to radio the boat to pick up food. Two wires trailed off this small radio.

Gamble hooked one wire to his belt. It was his own invention, infinitely superior to the type of radio used in the yesterday of three thousand years before. He looked around abstractedly, his mind lost in a tremendous, efficient, scientifically planned future.

"Where's a water pipe?" he asked, still abstracted. "I need a running-water pipe for this radio."

Prescott, once newspaper publisher,

swore for one of the few times in his life. He pointed at the disappearing boat. "Out there! Water pipe! Oh, hell and damnation!" Then he looked at Gamble hesitantly, speculatively. He began to wonder.

XIV.

GAMBLE and Drega were more alike than they imagined. Gamble, too, had the dynamic urge to do things. He, too, was an organizer. But where Drega organized and drove men, Gamble organized and drove science.

It was with cold detachment that he had put mankind into suspended animation—for between fifty and seventy-five years. Somehow—it shocked him to think it even possible—his calculations erred. Three thousand years slipped by. Only a time-resisting blanket of pure hydrogen had saved his laboratories.

Yet, from a scientific standpoint, the error was a benefit.

Take gold. Drega had said cheap gold would shatter the world's economic system. Well, the system was shattered—completely. There was no longer reason for Man to think of money or investments. They could build a new civilization free of the inherent traditions and weaknesses of the old.

This would be a civilization of pure science!

Gamble delivered his promised feast to the clan—fourteen cases of food. Three thousand people looked at the small pile with astonishment.

Gamble smiled. "Concentrated. I assure you, it is sufficient."

His four assistants prepared the lavish feast in a special catalytic stove. Twenty-three hors d'œuvres occupied a space about one inch square!

But—the course was delicious. So was the half gill of soup. At the end

came a striped pill about the size of a peanut.

"What's this?" Prescott grunted skeptically.

Gamble smiled. "A complete banana split. Twelve trimmings."

The copper man leaned over to Lucky. "I'm not hungry, but I'll be damned if I eat yet! A dinner just don't seem right unless you got something to wade into."

Later Lucky found him nibbling joyously on a piece of dried fish.

Early the next day Gamble began classifying people, picking out leading mathematicians, architects, metallurgical and viscose chemists, electronists, engineers, artisans and technicians. He gave the afternoon over to physical inspection.

"Terrible," he muttered.

Lucky grunted. "The white-collar workers are healthier than ever before! Lilly Peters, who used to keep our books, knocked the tar out of a coal heaver last week!"

"Oh, physically the clan's all right," Gamble said negligently. "But I fear malnutrition of carbohydrates has reduced the capacity for acute concentration. How long can you think of one thing?"

Lucky's eye fell on Lulu Belle. "I've been thinking about one thing two years."

Gamble examined him as he would study a bug. "Amazing! Perfect case of arrested adolescence."

Lucky said, "Huh?"

"About thirteen, I'd judge," Gamble said.

Lulu Belle eyed Lucky suspiciously. "You'd better be more than thirteen if you want to marry me, Lucky Flagherty."

"Oh, we'll treat his adrenal glands and bring him up to age," Gamble announced. "As soon as he matures he'll realize that you're the wrong girl for him eugenically in any event."

Lulu Belle glowered after Gamble's back.

MATERIAL for clothing appeared, but it was a heavy, mottled-gray pulp composition. The women looked at it doubtfully.

"Oh, the silk was just a test product," Gamble explained. "It's obsolete. This is both warm and cool and waterproof. It allows the skin to breathe. It can be discarded like paper. You'll notice seams along the edges. Wet them and press them together and your clothing is made."

"But it won't be stylish!" Lulu Belle complained. "It looks like mud."

"Styles and color are anachronisms," Gamble said. "They have meaning only to the savage."

"But I'm still a savage!" Lulu Belle announced.

"As soon as we have time," Gamble said tolerantly, "we'll treat glands to rid you of such hangovers."

"Well, it looks like progress is here in person," Lulu Belle noted sarcastically to Prescott.

Prescott said, "There's a lot in what he says. We are still thinking with the minds and memories of three thousand years ago."

Gamble was highly disappointed with reports on the city. "We'll need comprehensive mineralogical and chemical surveys immediately," he announced.

"But the cannibals are still out there!" Lucky said.

"Highly interesting! The human body's ability to adapt itself to violent changes is one of the mysteries of science. We will have sufficient specimens of cannibalism and mineral diet to make real studies."

"Are you going to kill them?" Prescott asked hesitantly.

"Oh, by no means! Live specimens are more valuable. We'll simply paralyze all animal activity in the cannibal belt for a few days."

His next step with the clan was an antiseptic chemical bath, running them through a contraption like a sheep dip. After that, an electric treatment toned up the glands and vitality. It had a miraculous effect. Wounds, cuts and colds which had been weeks healing, healed in twenty-four hours.

BUT GAMBLE might have foreseen much from the clan's reaction. Mild ailments had given individuals something to think and grumble about. They had nothing wrong with themselves now, and their minds turned to whatever else they could find.

There was much gibing about the pump and endless pipe which Gamble had to use for his "super" radio which had to be hooked up to a running-water pipe for transmission.

Becker, a radio operator, snorted, "That's progress!"

Gamble's laboratory was lighted by highly advanced methods, but he kept a supply of "electric bottles" which he presented to the clan. A twist of the top caused the bottle to shine. Small appliances could be plugged in.

Preliminary surveys showed heavy surface ores, and the exact location of tantalum, silver, bronze, gold and heavy copper supplies. Soaps, tars, glues and waxes had been located. A large chunk of heavy purple metal was brought back.

"Gold-aluminum alloy," Gamble noted with interest.

"I've always wanted a set of gold plates," Lulu Belle enthused.

Gamble sighed. "A set of iron plates would be more valuable right now."

The metallurgists were excited over the possibilities of unknown metals and alloys as the result of chemical action, pressure and the passage of time. Never before, for instance, had copper been soaked with formaldehyde or prussic acid and left to corrode in salt atmosphere for three thousand years.

Gamble called a meeting.

"We are going to build an entirely new civilization for the first time in history! All previous cycles have grown out of the traditions of old people."

The architects, particularly, grasped the immensity of the vision.

"We need steel in large quantities," Phillips, most visionary of the architects, noted.

Gamble shook his head. "Steel passed with the world's slumber. A much better material is *tantalectron*, for some years tested and the technique of production secretly perfected. It was withheld for fear of wrecking the open-hearth steel industry. Three hundred tons of mild steel would be required to give the equivalent tensile strength of one ton of *tantalectron*."

"Is that a theoretical comparison?" Phillips asked.

Gamble's eyes lit with pardonable pride. "No, it's a practical working comparison!"

"Could open-hearth furnaces be converted?"

Gamble looked boyishly embarrassed. "There is a slight difficulty. Nitrate is needed from Chile. And special glass furnaces are needed for smelting. We know how to make glass, but so far we don't know of any substance in which glass can be made in quantity."

PHILLIPS sprang into the awkward silence. "What is the first vital necessity, Gamble?"

"Gold." Then the scientists explained, "We need considerable quantities of gold wire to maintain our food supply. But there is something more important."

What could be more important than food?

"We can transmute gold into highly resistant steel!"

"Is there enough gold?" Steig asked.

"The process results in expansion by both weight and volume. All the duro

metals should be left. We'll make a new alloy."

Lucky whispered to Prescott, "This is getting a little complicated."

Prescott snapped, "You're not on the editorial page! That reminds me, I must put in a bid for presses. No protection of public interests without a free press. Harrrrumm."

Gamble was saying, "There is more free gold available than any other metal. It should be a simple matter to get into the sub-Treasury and Drega vaults. Another point is that most of the power equipment I can give you operates on atomic energy. Inversely from transmutation of iron into gold, with a high production energy cost, when transmuting gold into iron, there is a high atomic energy by-product."

XV.

IT WAS TALLIS of the Tallis Vault Works who pointed out: "You're going to have difficulty getting into those vaults. It will surprise me if there is any noticeable corrosion."

Gamble said, "We have electronic torches which could cut the vault by disintegration. But they use radio-active substance of exceptionally high wave length."

Pritchard, the electronicist, nodded. "It would break down the vaults all right. But—also the gold before you ever got to it."

Salter of the Corinth Glass Works looked up hesitantly. "We haven't acids or explosives; what we need is some solvent powerful enough to take concrete, iron, copper or lead in its stride. An acid glass—one with excess silica—is the nearest approach to the universal solvent I know of. But we need clay."

Gamble was shaken with growing doubts. Was civilization, *science*, to crumble for want of clay? Good cruci-

ble clay was almost a treasure and came from distant places.

Salter said grimly, "We can try local clay and prayers. The clay by itself won't make Indian pottery."

They knew their clays and sands intimately, those lean, liquid-death challengers. With Gamble's boat, they searched the shores. But they did not find their clay along the shoreline. They found it when Gamble came back from inspection and Salter picked a piece off his boot.

"Now we need potash and lead oxide," Salter said energetically. "We found a coarse sand that will do."

Gamble said, relievedly, "I can make the potash and lead oxide for you. How much do you need?"

"About two tons of high grade ash and five of lead."

Gamble stared. Salter was serious. "That would be two months' work for the laboratory's combined kilns! And this new kiln won't be finished for weeks."

Leading men of the new world, glass-makers, electronicists, chemists, engineers, scientists stood with set faces. In that clan there were men who knew how to direct any activity of industry or science.

But not one man could work from the ground up! They thought in millions of kilowatts or volts, hundred ton lots, hundred thousand horsepower equipment. They were above the raw earth and nature, unable to get down.

Drega had recognized this and started at the bottom.

Lucky whispered, "Remember Abe Lincoln? Here's the gang whose legs aren't quite long enough to reach the ground."

"You," Prescott said, "are going to get fired—hm-m-m—as soon as I can hire you again!" He was thoroughly sold on progress in big jumps. He wanted a printing press again.

THE FIRST snow flurried that morning. A cold wind blew off the river. But Gamble's clan were in excellent spirits. They had warm clothing.

It was unnecessary, with the new plastic clothing, to wear outer garments. It was windproof, and the inner finishing acted automatically to hold heat near the body temperature. It was an inherent property of the material.

Gamble's face was hard as they started operations on the sub-Treasury vault. His laboratory had not been set up to produce supplies in industrial quantities. He had taken a risk which he had not mentioned to anybody. For the three utility machines—they could be used for almost anything from hoists to drilling—he had taken fully three-quarters of his remaining supply of atomic fuel.

Unless they got at that gold, his laboratory was going to become a finely keyed mechanism without fuel. And to get more fuel out of the ground they needed some of that gold transmuted into iron and steel and energy.

They had, they all fervently prayed, solved the problem of getting the vault open. They would tackle it with limited glass operations.

Gamble had brought down his one tractor, a heavy steamer which he considered the most efficient motive power for this type of work. "I have never seen an obstacle other than a sheer rock face it could not surmount," he said. He was pleased with the way it was hauling a load of clay.

Fate presented the other obstacle. No March Detail had goose-stepped ahead of the heavy unit. No Drega had foreseen catastrophe. It suddenly dropped from sight. There was a splash and a jet of water. When they grappled, they found it jammed solid beneath thirty feet of water.

Sand, potash, lead oxide, clay for the crucible and lime to aid the coke fire

had been hauled by hand. The coke had come from Gamble's precious laboratory supply. Gamble, himself, had treated it with a special hydrogen process.

With materials in place and fire pit and chimney fashioned, Salter signalled Gamble. "I'm not sure this can be done. It wasn't in the textbooks." He smiled wryly. "It takes exceedingly good clay to hold molten glass. If we tried making a hard crucible first, we might waste ten or twenty weeks. So we've left blow holes in this clay form."

Gamble nodded. "You'll melt your primary mixture and hope the form doesn't break up before it coats."

Salter shook his head. "The clay is mostly a mold for a glass reinforcing. If the reinforcing holds and the clay doesn't crack away from the blow holes, we'll have glass."

Salter looked at his gang, nervous with unfamiliar units and materials. They had to work down in the trench beside the vault. If that form failed—molten glass was going to sweep out knee-deep.

SILENT, the clan stood around while Salter studied every vapor steaming from the form. "Drag fire!" he yelled as the steam suddenly changed tinge.

In the pit there was furious scrambling to drag the searing fire. Fascinated, the clan watched the skin of the glass workers blister and peel back from the raging heat. Within five minutes, somebody had to get beneath that precarious form and knock loose a bung to dump the molten overload within.

The pit was raked, chemicals to cool it thrown in. Water got into the pit. There was a spot of ice not two feet from where the ground itself burned.

"She's clear!" the gang foreman called. "Knock the bung?"

His eyes were too puffed, and his



Gamble thought of Salter—Salter dying horribly, knowingly, for success. But—what if there were no success?

voice too thick to tell the emotion there. But Rumplemeyer knew he was asking for a quick and terrible exodus from this Earth. Ordinarily, a reliable crucible was lifted by automatic crane and carried to a distance for dumping.

"No," said Salter, "come up." He

waited for the tired men to clamber from the pit. He signalled Rumplemeyer. "You understand the mixture for tomorrow? You'll have to gauge your heat. There are no pyrometers."

Rumplemeyer said dizzily, "Yes, I understand. But you'll be here."

Salter said, "Don't forget to add lime silica immediately when the vapors turn deep yellow."

Calmly he picked up a heavy sledge and climbed down the ladder. Carefully he studied the trench flooring and the bottom of the clay form. A tiny jet of milky substance broke out a hole and spurted past his shoulder.

Salter looked up at the crowd once.

Lucky said, "Jumping Judas, you can't——"

Salter swung the sledge. A shower of molten glass flew. Again he swung. A thick milky jet pounded out from the bottom of the form. It looked beautiful and harmless. Its vapors spread heavily.

Lucky's glance switched back to Salter. The vapors were reaching out thickly to hide the man. But Lucky saw the white stuff rising around him.

Only it wasn't rising. It was eating him down from beneath. Salter's one shriek rang as his head disappeared in the molten liquid. Then the trench was filled with smoke and vapor and fumes.

Only once that night did Lucky speak to Rumplemeyer. "Was it necessary to stay down for that last strike?"

Rumplemeyer nodded heavily. "The form was beginning to go. He had to get that weight out of there quickly. It would have been the same if the whole bung had gone on the first strike. But he should have let me do it."

Gamble, too, spoke only once, softly to himself. "For science," he said in tribute. "Ah, that is the way to go." He did not know that Lucky was listening. The reporter wondered vaguely whether——

IN THE COLD light of dawn, Rumplemeyer took tools into the trench and climbed onto its slick, bluish-tinted floor. Carefully, he broke off one of the milky jets that hung like icicles from the clay mold. Then he broke out a measured section of clouded glass beneath the

mold and carried the chunks above.

The sun was just rising as they placed those chunks into an ancient Ming vase and lowered the vase carefully into hallowed ground behind the remaining cathedral. Rumplemeyer smiled through his tears. He did not know the vase's museum value, but he recognized the skill of a great artisan.

"It is good," he said simply. "It is the way he would have liked."

An hour later, Rumplemeyer was swearing at crazy descendants of apes who didn't know how to give a glass man the things he called for.

XVI.

NOT UNTIL years later, when the bits of the puzzle of those days fell into place, did Lucky fully understand Gamble's panic that bleak morning.

Gamble was frightened, frightened of an abstracted thing—*failure*. He did not think of himself, or the millions of lives depending upon that gold. He did not think of the bitter struggle back to civilization.

He thought of Salter dying knowingly and horribly—for *success*. What if there were no success?

New determination fired the glass gang. They were to need it in the coming hours. Rumplemeyer had sounded the filled crucible from twenty directions with a bronze rod. It was too soft to be sure of. Maybe it was better so. It would not be so liable to split.

Without hesitation, the gang mixed materials, saw to their working room, inspected every inch of the vault against which they would try to boil glass so that if one man went, another could instantly take his place.

It was not unusual "*to go*" in that trade. A dizzy moment from heat or fumes, a slip, a second of unwariness—there was no rescue for a glass man.

In spite of the shock of Salter's death, Tallis felt glad that he had lived to see

his own handiwork. The vault cement was solid. Not as solid as it had once been, but more solid than any other cement in the city. That was because of the intricate design of the reinforcing, and the special chemical nature of the cement. The iron reinforcing had corroded very little and the cement had given to the growth within. It was still sound.

It was not until later that night that the molten glass began to form. With great care Rumplemeyer nursed it along. There was a trick to the cooking of glass, an even temperature throughout. Now, though, he needed an acid glass.

At daylight they added the final mixtures. At noon Rumplemeyer got so close to the vapors that heat peeled flesh off his nose and lips. Sudden puffs began to issue from the crucible and he nodded. "It is ready."

He turned below to personally knock the outlet against the bank vault. It was tricky working with molten glass spattering down beside their very sides. Each shift of the crucible spelled possible destruction.

Slicing out like a thin milk-white snake, the molten glass ate against the vault. It went through cement and rust and iron like butter. But Willis shook his head. Beyond that, twenty-two plies of crossed steel. And still beyond, more solid steel.

But even that might be negotiated. The difficult part still lay beyond—four separate two-inch plates of copper, with heavy ply and woven layers of lead between. Willis remembered that there were forty-eight thousand cubic feet of copper and ninety-six of lead.

FOR THREE solid days the glass gang worked. Hourly, they were carried from the pit and returned when they came to. Their bodies looked like raw meat and then began to turn black. On the third day, Rumplemeyer staggered out of the pit. He had lost one

third of his weight, and he had been solid bone and muscle to start with.

"We have a hole through the steel block packing and the next steel plate."

Gamble said, "Magnificent!"

Rumplemeyer said, "No. The heat is melting the copper and lead inside. It comes through the hole as fast as we burn. If we stop, it hardens and we are nowhere. All that inner lining will have to be cooked out. And when we finish, all the space will be filled with pressure glass."

Gamble whitened. Willis nodded. Gamble said, "What can we do?" Never had he asked that of man before. And he was asking a pit foreman!

Rumplemeyer shook his head. Salter had—

"We'll get through, sir." His voice was grim. "It ain't going to be easy, but we've got only about three feet of copper and lead to cut. The copper goes into solution in that hot glass pretty easy. Lead'll run. If we once get a hole into that lead, let it harden again, then run some more glass, we'll have a glass-lined hole. That way, we'll reach the steel beyond."

"How—long?" asked Gamble tightly.

"Six weeks—workin' like hell."

Gamble sat back heavily. "Work like hell then, Rumplemeyer. We've got to get that gold. Gold——" He laughed grimly and rather unsteadily. He'd brought this suspension—this ruin—because he hated gold and the compromises gold and the love of gold had forced on that long-gone civilization. And he—— "Yes, work like hell——"

Work had been called off, and only a fire-crew was on duty. The others were being treated by Gamble's experts. Queer radiations that accompanied some of his atomic release experiments were utterly deadly to infection, fearfully and wonderfully stimulating to healing. But they exhausted the patient's body so that he must sleep twelve full hours, to arise sound and fit.

It was miraculous, but Gamble could find, now, no gratification in this knowledge that made it possible to turn baked meat back to sound, living manhood. For Gamble accepted automatically the advanced tools of a great civilization. It was the lack of them—that boring through stubborn concrete and steel with molten glass—that paralyzed his imagination.

Gamble did not know how men had first built their weary way through ten thousand years to civilization. Gamble could not find that road again, nor could his experts. If that gold vault defied them—if that slim chain of vast science his laboratory preserved should break—Gamble would be broken. He had no second string. Drega could work with raw rock and brute power, could build again. Gamble could not. He knew it.

TALLIS had been watching the glass workers, watching the efforts to break that mighty fortress of wealth he'd built. It was a grim satisfaction to him to see the impregnable solidity of it withstanding these assaults as it had weathered the three millenniums of time. He moved over, now, toward Gamble and Rumpmeyer, near the healing radiations.

"They're digging a trench around toward the front of the vault. What is the plan now, Rumpmeyer?" he asked curiously.

"Shunt the cooling glass away before it hardens in place and plugs the hole it cut. We've been breaking it out with sledges, but it's where we can't swing, now."

"You stopped just short of the lime-layer, I noticed. There's——"

Rumpmeyer turned sharply. "'Lime-layer?' What the hell—what do you mean, 'lime-layer?'"

Tallis stepped back startled. "Why, between two layers of two-inch copper there's that layer of lime—lime-cement --I told you about."

"What's 'lime-cement?'" snapped the glass man.

"Quick-lime and water mixed, pounded into place. It stops oxygen torches. It won't melt, and drinks the heat."

Rumpmeyer sat down weakly. "Oh, Lord. Lime." He shook his head slowly. "One of the few things on Earth that glass can't cut. We have to use an acid glass. Lime glass is basic. It won't cut steel. It won't cut copper. And it won't melt."

Gamble took a hesitant step toward the steaming pit where men still worked. Some of the others of the clan were digging there. Shovels threw dirt up to a mound of raw earth.

There was a shout down there suddenly. Then a lurid cursing, and sudden silence. Two of Gamble's medical assistants started forward on the run. Six of the glass workers mounted from the pit, cold fury blazing in their eyes, their blistered faces. They walked past the medical men unheeding, their eyes on Gamble. The biggest of them halted menacingly before the scientist, a heavy pick-handle clenched in white-knuckled hands.

"Listen, you run-down genius, did you know about that vault?"

"Know—know about——? You mean the lime? No." Gamble shook his head despondently. The slim thread—the chain to the past—was broken.

"Lime, hell! The door, you damned crackpot! You let Salter die—and the door——!"

"Oh—," said Tallis softly. "The time lock would go off——"

XVII.

DREGA was later to laugh about this. It was the very gold Gamble condemned that made possible his resurrection of civilization. Without it, he could not have sustained the food supply, nor mined iron in time. For Gamble's world

simply did not understand the simple ways of their forefathers.

Gold gave to the artisans and technicians the tool they understood and needed and had confidence in. It gave them *power*. It made possible again the correlation of experts and specialists, for many men knew only one division of their trade.

Phillips, for instance, could not cut and join pipe, although he could figure the total pipe length in a building to inches. Foundation masons were lost on precise chimney work.

But it was not possible to jump immediately into the world Gamble dreamed of. His laboratory worked at peak capacity. He had expert help. Many of the scientists, professors and post-graduate students of the university had survived.

He had reclaimed the cannibal tribes and released a surprisingly large number of the people still living underground. From eighty-four thousand people who had survived, he could select specialists in almost any line.

The first work was reclaiming the spoils of the dead city. But equipment was terribly limited. They needed tremendous amounts of lime and coke and charcoal.

To Gamble, charcoal had always been something which one telephoned for and received. Occasionally, for exceedingly delicate work, he made his own in small quantities, but in a special electric oven designed for just that. There was no material to make a larger oven of that order.

Thornton was a former owner of a vast charcoal works supplying the alloy-steel industry. But Thornton had never made anything except specified high qualities of charcoal. He had ordered special woods from one locality, clays from another. He had used chemicals which were not available.

His pits had been specially prepared for draft. He simply said to the yard

foreman, "Wouldn't it improve the char combustion if we used forced draft and increased the pressure?" Exactly what the foreman had done, or how, Thornton did not know.

He took the woods and clay at hand. The clays he knew, but the wood grading he had to take on another's say-so. Except that it was wood of a quality and type his works never would have considered, he knew nothing about it.

THERE WAS a battle over the use of the five power saws between Phillips and Thornton. Phillips was busily constructing urgently needed temporary work houses. Thornton wanted wood for fires immediately. Both of them had to wait. There was a slide at surface mine No. Six, and Rickards got the saws to cut emergency reinforcing timbers.

Gamble considered handsaws archaic, but to supply the present shortage of machines he made one hundred cross-cut saws at his laboratory. Carpenters and woodsmen felt and sprang and tuned them with admiration. Never had they seen finer steel.

The only trouble was they wouldn't saw. They squealed and jammed. There was no kerosene and sawing was difficult at best. A lumberman said, "You set the teeth wrong. They shouldn't be even."

Gamble colored. The type and tempering of that steel was such that the teeth couldn't be changed. He had made the steel purposely to spring back into original shape. Reforging ruined the perfect quality of the steel. But the saws worked.

Thornton superintended the piling and smothering of charcoal piles himself. He knew the piles were right, the proper amounts of clay laid on. How often had he worked on graphs and blueprints far into the night to get the right angles, the best positions for blowholes,

the right amounts of clay and pressure?

But his furnaces had been a hundred times the size of these. They had heat and pressure meters, and intricate mazes of drafts. If he said, "Force sixteen draft," the foreman carried out the rest. It was the foreman who arranged the draft vents, the damping, the piling. And the foreman was not there.

A talkative old man watched Thornton's gang. He talked incessantly about potato farming. When asked his opinion on anything he would go off into long-winded details of why it wouldn't work. The charcoal, he said, would never cook.

It didn't.

Three times Thornton tried his luck. The last time he got a poor quality charcoal. Why, he didn't know. He had built his furnaces exactly as before. The garrulous old man shook his head.

"Well," Thornton snapped, "maybe you can make it?"

The old man chortled. "Make it? I been making it for nigh on sixty years."

Thornton glared. "Why didn't you say so?"

"Nobody asked me."

The old man blew his nose, picked a tooth and regarded a bit of food on the end of his fingernail. "Why back before there was automobiles——" he started.

Thornton forced himself to listen. Twenty minutes later the old man said, "With a small furnace like these you got to burn your wood three days before smothering."

Thornton snapped, "You idiot! The wood would burn up!"

"Not if you do it right. You lay on your first blankets, but you don't put on your pressure cover. Then your vents aren't big enough for a small furnace. I reckon you just reduced the size of a regular furnace, but it don't work that way."

The old man built the next fire. It made prime charcoal.

THE WINTER cut into charcoal operations. It froze the clay beds.

Gamble's laboratories were working day and night. There was the food supply to be maintained which took up a large part of the staff's time. There were compounds to make, and surface ores to be tested.

Gamble himself was busy on the perfection of new alloys which could be made out of reclaimed metals. These required wholly new treatments, since the original metal had had strange alloy-elements that must be allowed for. Each new process required experiment with chemicals which could be made from material at hand.

Surrounding communities had not entered into the spirit of the new civilization. Many of them were savage, and people either attacked or hid at Gamble's approach. Gamble was more bitter than ever at Drega. He had sent across the river and asked for fifteen tons of a common, but particular type of mica. He had offered tools, equipment, explosives to mine it with.

Drega had held him up for fifteen tons of prime cement and kept the tools to boot. For a week the entire clan had had to stop work and concentrate on machinery and materials to make that cement.

In mid-winter it became apparent that the new type of atomic power would not meet all needs. Men did not yet know how to make machines which it could operate, and they were careless with it. A crack electronocist had been blown to bits. Rushed and unable to find a meter handy, he had trusted to judgment to adjust the flow.

Others were afraid of the atomic power. The lowest units ran a quarter of a million volts of d. c. which could not be transformed, and they had no insulation against the charges of mutilating death. Half a dozen men had been killed while setting up power lines of iron wire, charred to cinders by the

giant arcs which burst across insulators. Oddly, one blast of rampant power had knocked a lineman three hundred feet, but except for a badly burned spot on one shoulder, he had suffered no great injury.

Morosely, Gamble ordered hydroelectric and coal plants. It meant a decided change in plans. It meant bulky, cumbersome and heavy machines were needed in quantity. It meant cable and insulation and tremendous man power. It meant time and work investment for an obsolete type of power which would not be used for more than four or five years at the most.

"Cheer up," said Phillips. "The men know how to handle this. With power they're familiar with they can quickly make equipment for atomic power."

BUT GAMBLE did not cheer. Why couldn't these men learn to use a new power which simply required caution and respect? The old forms of electricity, like old steel, were a compromise. Compromise was the basic fault of Drega's world, the very core of the old civilization's canker.

The great coal stores were over by the Brooklyn shipyards. A savage clan of cannibals held that area. A sizable expedition set out with a paralyzing ray machine, but it was delicate and could not be easily transported. It took them five days to find the tunnel in which the most important tribe lived. Gamble's men were almost struck down from behind before they knew their danger. But a heavy shock of the released rays put all except the insulated party into a state of physical paralysis.

Gamble found the leader, obvious because of three fur pieces, one of them a horsehide. They were not well tanned, and their warmth was doubtful. Gamble briefly stated their wants.

The savage leader studied them shrewdly. Once he had been a long-shoreman. He saw that Gamble's peo-

ple had things he wanted. What mattered how he got them? As soon as he found out, he would kill them off and have everything. He agreed.

The need was for transport boats. A flat service type was decided upon. Gamble produced in one evening the specifications for an easily made plastic which would serve for hulls. It required wood and asbestos and tar. All were available on the island, but it threw the heavy work back on the lumber and mine departments. In the bitter, wet cold of a seaboard winter, these divisions sweated while others took things easy or worked in comfort in heated buildings. There was grumbling.

But with the coming of old-type electricity, there was satisfaction. Artists and technicians were busy, absorbed in their work. They began to catch something of Gamble's vast dream. They spent hours working out ideas and problems which were child's play to the leaders, but tremendous strides in viewpoint for them.

After one outbreak in which they were badly shocked, the Brooklyn clans settled down. Prescott noticed their increasing lethargy. They had been wild and strongly tainted with criminal instinct, but they had been vital. After electrotherapy had brought their glands in harmony, they became listless, a passive group. They were better citizens.

"But their spark is gone," Prescott said.

"It will take three or four generations of scientific breeding to build up their brain capacity," Gamble said.

Prescott looked at the men guiding the new civilization and was not sure the change was worth the cost. They were a brilliant lot, these new leaders, consumed with scientific zeal. And most of them were about as colorful as the clothing Gamble had supplied. Privately, Prescott was still thrilled by swashbuckling pirates.

THE GREAT catastrophe of the year came in the spring. Gamble's big boat had been left out. In the spring break-up it was crushed, and much valuable equipment went down with it. But most valuable was the motor. Although of a radically advanced type, it had been made of the finest crucible steel.

No other steel would do, and it was impossible to duplicate without the original workers.

Gamble sent an expedition across the river aboard a scow. They had with them his atomic-powered automobile, and they were to get through to Pittsburgh and bring back the men who made that fine steel.

Amused, Drega let them through for a price. Gamble had to supply him with a complete electro-power plant. There was no choice, as Drega held several of Gamble's best men hostages.

Twenty miles past the crude town Drega was building, the car broke down in the rough country. The expedition got out and hiked. Drega found the car, dismantled the motor, and used it for hoisting.

Five months later the expedition returned. They had traversed grimly savage country, although the rural sections seemed to be building farms just as those they had known. Two of the expedition brought back no ears.

Gamble was livid with outrage. They had found the manufacturer who made the steel. When they told him about the boat, his eyes darkened.

"Tell Gamble," he gritted, "that any man who managed to bring a boat and laboratory safely through what happened, can do no business with Pittsburgh."

Only fifty percent of the population in that district had died. But of the remaining, sixty-one percent were maimed.

Gamble said, "They don't understand."

Prescott calmed him. "It will take a little time for them to get the signifi-

cance of this. As soon as they see what you are aiming at, they will fall in line."

Prescott was in very good standing these days. He was a good outlet valve. He blew his nose on a paper handkerchief. "By the way, Simon, the new presses are almost ready. It will seem funny, printing by light, but it makes a better looking format. What are we going to do for paper?"

"Minerals," said Gamble. "It's quite practical."

The legitimate excuse to experiment with a mineral paper was what had motivated Gamble into having the photopresses made for Prescott during these busy days. Personally, he considered newspapers obsolete. Soon, now, they would have television.

It did not strike him that his rationalization was particularly human. Gamble had little sense of humor.

XVIII.

TEN YEARS made a tremendous change in life under Gamble. The great crisis had come in the third year when the requirements of work overtaxed all possible power supplies. They had harnessed their whole side of the river and made the tides work, but still there was not enough power. For Gamble wanted to do more than simply give back a civilization. He wanted to see the new civilization working.

He found himself seriously overburdened with the transmutation of energy. The simple things, catalytic action of sea water, increasing the efficiency of engines, perfecting quality and strength of products, these things his division chiefs could handle. But the transmutation of energy was beyond most. He worked with a handful of scientists.

Now he saw he must take the time to teach others. It meant months spent instructing men in handling this leashed lightning of atomic power. A new generation of young atomic-power engineers

grew up, though. They understood and handled Gamble's mechanisms.

With the solution of the energy problem, Gamble's civilization had spurred. But it had not helped to extend his influence. He now controlled Long Island and the former five boroughs of Manhattan. He was on friendly terms with clans to the north as far as Albany. This terminated his influence.

The new civilization was using plastics heavily. All clothes were made of plastics, many building materials and even machines. But the products of other climates were missing. Expeditions had been sent to tropical countries with building materials and metals for barter and returned empty handed. The natives weren't interested in work. The white men who had driven them before weren't interested in the materials offered.

Substitutes had been found, but the problem of woodpulp grew more serious daily. Most of the timber on Gamble's land had been utilized in making plastics of various kinds. Gamble had saturated the country to the north with iron, shovels, plows, crowbars, saws, glass and building materials in exchange for woodpulp. Now that rural communities were beginning to find their feet again, they had become shrewd, hard bargainers.

There were shrewd and hard bargainers in Gamble's clan, but they had not shown great interest in their talents. What did it get them? They already had everything the new civilization had to offer. It was not pleasant going up into the woods for extended periods of trade. They didn't go.

GAMBLE himself had made one trip consumed with a desire to offer the people the great benefits of his civilization. He had almost been lynched three times. The people up there had no desire for his world of science. They were interested, they listened to what was being

done. A few would have liked radios, movies and television machines. But he could have gotten more real interest with jerks of good old-fashioned tobacco.

"All I know about you, mister, is that you're making cheap gold and all my life savings in insurance aren't worth a split rail!" a venerable hollered.

"But you don't need insurance," Gamble explained. "Whatever you need, civilization will give you."

"It won't give me back my life savings," the old man insisted.

Gamble tried another group. "Don't you want the benefits of science?" he queried.

"We're doing all right," they said.

Gamble controlled his exasperation. "Here, take a simple case. Wouldn't you like hot and cold water without walking to the spring or chopping wood? Just pressing a button!"

"What's the sense of that when we got the spring and the wood?" asked Jed Hawkins. "My old lady ain't got enough to keep her mind off other people's business the way it is."

Gamble returned, nettled and vexed by human dumbness. Utter stupidity! He couldn't understand this bullheadedness. He had lain down in a patch of poison ivy and couldn't treat it until his return, which made his mood worse.

Occasionally, there was intercourse with Drega, always at a staggering cost to Gamble. Gamble's ships were forbidden to land on Drega property except on notice. Those of Drega's clan who wanted could join Gamble's people, but they couldn't come back.

At first this had piqued Gamble. But slowly he saw that he was winning out. There were occasional desertions from Drega's harsh rule. People heard about Gamble and wandered in from distant places. This pleased him. But it would have been better if they had been a different type. Those who came to stay showed a marked tendency toward laziness or pseudo-philosophy. Particularly

those who left Drega. They wanted to be honored for having an idea. Gamble's people had many ideas as a matter of course.

Gamble had made one attempt to make peace with Drega. He had done this in spite of personal antipathy and bitterness. He thought his civilization owed it to others to offer them its fruits. The answer came back that Drega liked the struggle of old-fashioned existence.

Gamble learned that Drega had opened trade with the whole interior. He had clumsy wooden boats in operation, and two steel boats were being made at Pittsburgh. But the backbone of Drega's trade was whisky.

Gamble would not stoop to this. But it annoyed him to look across the river and see a tower of good steel rise into a replica of the old Drega tower.

IT WAS TYPICAL of Drega that his tower dominated the Hudson while men and women within fifty miles starved and went without clothing. But it worked. Word went far and wide. People began to stream to Drega's town for trade and celebration. The city flourished, and Drega's influence grew. Drega was hampered by Gamble's work in one way: as fast as a new standard—platinum—silver—wheat—was selected, Gamble's transmutation or trick production methods upset it. Since there was no definite yardstick for value he had to do much in barter. It annoyed him, but his real interest was the cheap labor possible under conditions. With cheap labor he could build—build endlessly. He was already arranging to put through the railroad to the coast again. Word had come there still was a west coast. It was a thousand miles farther away than it had been.

But all in all, Gamble could be pleased on the tenth anniversary of his rule. Around him, the city stretched in perfect plan. Broad parks which would flower were surveyed. There was a

stretch down one side of the city where airplanes would land. Beneath, there would be ground conveyance, beneath that, fast freight transportation.

The city plan was perfect. It began with deep mines. The island was a mineralogical treasure house. On lower levels were refineries and factories. There was a general utility level above that, such as depôts for food, clothing, material, theatres, etc. Endless platforms would eventually carry the people along this level.

Towering above that would be great skyscrapers, but of an entirely new design and construction and conception. Six of them were already built. Not perfect, but scientific advancement. For one thing, they had no windows. Why should they? They were properly lighted and air-conditioned inside.

It was true that people did not like working in them. But that was an anachronism—a hangover of memory. The new generation would prefer them. The one tower of glass which admitted natural light, Gamble let Phillips build because it pleased him.

In colonies around the city were small apartment houses and private homes. Citizens could have whichever they desired, as quickly as construction could take care of them. Gamble had been surprised about the choice. In spite of every conceivable appliance to make life easy, most workers chose apartments.

He had envisaged a city of comfortable, cozy homes with green lawns, and the people spending much of their leisure time—they worked a twenty hour week now—enhancing their gardens. Some had done this. Most had let their lawns run down. There was a growing demand that the city government furnish garden and lawn service. It was too much work to care for their own property.

Of course, fixing of the city had only just begun. Until two years previous, the clan had been barely able to keep

abreast of pressing, basic work. There had been keen interest in the future, and Gamble had thought his people would take great pride in their personal lives.

BUT THE FIRST radical slash of working hours had not brought this expected reaction. He could not quite put his finger on which glands were responsible. With ample time, security, all the necessities and many luxuries of life provided, his people seemed to forget progress. They were not even living up to their present station. And the new arrivals from outside, who had come in since the building work was done, were not all coöperative. More and more now were accepting Gamble's offer of a civilization that gave no pay, no money, but did not demand any for food, clothing or shelter either.

During the most hectic periods of driving work there had been sharp, vital debates, a flood of new ideas. People had been keen and active and interested in life. Some of the most progressive ideas, brilliant scientific work, and best literature had been written then.

But now they had leisure, they did nothing. Gamble had reports that there was even a falling off from movie attendance, and the television fan mail was dropping. The increase for slushy, clap-trap entertainment was startling.

"A matter of orientation," Prescott said. "This older generation has been through too much. The younger will be able to take hold."

Prescott was now in charge of the press and news-televising. He could not get much enthusiasm about the newer types of news dissemination. There was no way to see what you'd done or said after it had happened. It wasn't newsprint.

Gamble sighed. "Our first ship got back from Chile today."

"Ah, the nitrates! Now we'll get that *tantalectron*, eh?"

Gamble's eyes fired moodily. "The

Chileans won't do business with us. I sent word that we would send them whatever *tantalectron* they needed as soon as production got under way. They replied they wouldn't know what to do with it."

"That's Drega fighting you, of course," Prescott said. "Still—it's amazing the number of people who would rather starve than be benefited."

"It's getting serious," Gamble stated. "We have a good many minerals here, but we need many from outside. We've consumed all the surface ores left from the old city. We need copper, radium, oil, chemicals and vanadium. The atoms of some metals are so unstable my transmutation won't make them. Pittsburgh turned us down on vanadium pentoxide again. On the Gulf, it's a serious offense to ship us sulphur."

"Of course, you could get it by old-fashioned trade," Prescott offered.

GAMBLE smashed his hand on a plastic table. "That's exactly what we can't do! We've proved the practicability of a scientific civilization. Now we need it on a world basis."

He strode around an electrode and glared at Prescott. "That coyote, Macken, was down from upstate yesterday. He's got a corner on all the jengsen available, and he won't let it go. He's holding for a market. We need that supply for gland stimulation. Our people are getting lazy."

"What did he say when he saw the new city?"

Gamble became almost unintelligible with fury. "He said the old city had more skyscrapers and he missed the night-clubs and burlesque!"

"You should have given him an electro-treatment for generosity and logic."

"I did," Gamble gritted. "I gave him enough to kill a man. The old Yankee skinflint gave me a pound of blueberry cobbler and told me to forget this civili-

zation business and come up and go fishing!"

"Well, there's some good news," Prescott said. "The ten-year-old class in school passed one hundred percent in trigonometry."

"They ought to be doing calculus!" Gamble snapped. He collected himself with effort. "By the way, I'll have to shut down your paper."

Prescott licked dry lips.

"I'm sorry," Gamble said. "We're short on materials and need that photo-electronic equipment for conversion to astronomical uses."

"But the public——" Prescott blurted.

"Oh, they have television. Newspapers are really obsolete," Gamble said.

Prescott went back to the one glass building and sat looking through the single foot-square clear glass window which he had secretly bribed Phillips into installing. Phillips' one weakness was publicity. He loved to see his picture in the paper.

Prescott thought, "Maybe I've lived too long, but I can't conceive of a healthy civilization without a press."

XIX.

PRESCOTT said, "Send Flagherty." He did not have to move. A highly sensitive cell oscillated to his desire to see one of the staff and threw the speaker open.

Lucky came in with a bored expression. There wasn't much news any more. All the insane and criminals were cured by treatment. There were very few accidents. There were no fires or explosions. There was no gambling, or night-club life, or underworld.

"What's the late news?" Prescott asked.

"A dog bit a man. They treated the dog's thyroid and inoculated him with some mouse serum. Now he's chasing cheeses and running away from cats."

"Nothing else?"

"Page one headline is that a grave error has existed in estimated diameter of the Earth's orbit. It is now established at one thousand thirty-six miles short of previous estimates."

"Any building news?"

"Some swell stuff, but you ordered not to print it. Phillips has completed his final detailed city plan and it's a honey. But it involves the use of a number of chemicals and minerals we haven't got. Outside of that, Copper just ate some crabs, which are off the diet, and it upset his metabolic count. He got out of control and swiped a scow and was heading toward Drega's."

Prescott grinned. "What's wrong? Too much work?"

"Not enough. He said the only thing he ever really enjoyed was eating and sleeping. Now he doesn't work enough to get an appetite, and this formula food keeps him so pepped up he doesn't need the sleep. He's going over where the smelter men are sweating nine hours a day instead of sitting beside a bunch of buttons behind an insulated shield for four hours."

"Anyone go with him?"

"Rogers, the police captain. Fed up with taking hoodlums to a chemical psychopathic ward. Anyway, he hadn't had a case in three weeks."

Lulu Belle burst in unannounced as usual. She said, "I just heard Copper went over to Drega's and I think it's a good idea. I don't know why I didn't think of it before."

Lucky looked at her face and gulped. "Hell, honey, what's wrong here?"

Lulu Belle swept a hand over a very serviceable—and frowzy—looking dress. "What's wrong? I look like a sack of potatoes and he asks what's wrong! You can't get a decent dress in this town for love or money. There's no money, and all the men are too dopey to be interested in love!"

"That's a fine way to talk just when

we've decided to get married," Lucky said.

LULU BELLE took a deep breath and said very steadily, "Lucky, I'm not marrying you. You're getting as bad as the rest."

"What rest—whaddya mean?"

"The men in this damned city. You're not human any more. You sound like a calculating machine when you begin one of your dazzling conversations. You spent four hours last night spouting an explanation of what this new *alexzerces* force is, and how it will improve brain capacity. I don't want to marry a brain, Lucky. I want a *man*. I'm going over to Drega's, too." She stamped out of the room.

Lucky yelled at the microphone, "Gimme Doc Whipple!" The doctor's voice came on and Lucky nervously told what Lulu had said. The doctor laughed. "We'll pick her up. Don't worry. Short on vitamin X and a little upset."

Prescott was studying Lucky intently. "Would you have called the police to pick her up in the old days? Or paddled her little posterior?"

"Well——" Lucky stopped. "You're right. Hell, *she's* right, chief!"

Prescott said, "I still believe in progress and the stupidity of our old society. But I don't think this new one is complete. Something's missing. Something's wrong when a man as big as Gamble can't raise enough trust to get minerals and chemicals. Um-m-m. And photo-electric equipment."

Lucky said, "Chief, there's going to be a break. Things happened too quick for people to take. And the kids growing up can't take it either. The school system here is perfect. It's got more thought and research poured into it than anything else except the power project. It's so perfect these kids are looking a hundred years ahead."

Prescott lit a cigar. "What do they see?"

"A twelve-year-old in the graduating class at Murray High got up and walked out of the room this morning. He said he was depressed. They started to give him a stomach toner, but he said it wasn't that. He was just thinking that in another hundred years there wouldn't be any need for men!"

Prescott said, "That's not as far-fetched as it sounds."

Lucky dropped his voice. "Listen, chief, it isn't far-fetched at all. If we were getting the supplies here we need, they'd cut the work week to five hours tomorrow. They got machines to do damned near everything now, except think."

"Men will always have to do that," Prescott said.

LUCKY SHOOK his head. "Last night I was over at Polatov's. He had a break with Gamble a couple of weeks ago, and is living on minimum rations. We've been taking him bits of equipment and things. Do you know why he had the break? Because Gamble wouldn't give him time to work on an automatic brain! Now he's finished the thing—and it works!"

Prescott muttered, "Good Lord!"

Lucky nodded. "He isn't making this public. He just wanted to prove an automatic brain could direct a mechanism without outside help. It was a cat's brain and had real cat's eyes, alive in solution and nerves intact. He attached it to a static vacuum and let a mouse loose. The vacuum chased the mouse and caught it!"

"That would be funny if it wasn't Polatov. In ways he's greater than Gamble."

"He's going to kill this secret. But it won't be long before somebody else digs it up. What's going to happen if a bunch of those brains get loose on a civilization completely supported and

controlled by machines?"

"At least they can't reproduce."

"Unless they get some scientist into their power to make them. There are a few good scientists in this city who would like to help to take Gamble's place. Maybe some of those brains would pan out smarter than the man who made them."

Walters, the astronomer, came in looking gray and haggard.

"Good Lord! Get him a shot of electro-stimulant," Prescott said.

Walters said, "No more. It's these damned scientific gadgets that wrecked me." He blew his nose. "My wife just ran off with another man. It's my fault."

"What are you going to do?"

"Drega's offered me a new observatory they're building. And"—Walters was a teetotaler and he smiled cynically—"the equivalent of two thousand cases of malt whisky per annum. I understand that whisky is quite a valuable commodity over there."

The news ticker announced, "Polatov commits suicide. Explodes laboratory. Gamble says undoubtedly short on vitamin——"

XX.

THE CLOSING of the paper marked an era in Gamble's civilization. Long after, Prescott wondered whether the people actually missed the paper, or whether trouble was brewing in any event, and he simply fanned it by his own uncertainty and troubled state of mind.

Probably Phillips missed the paper most. He still appeared often on television. He was constantly in the public eye. But he missed the printed page. He had been wont, in the privacy of his office, to take out his scrapbook and read the most recent stories between sieges of intense work. It gratified his vanity and stimulated him to new endeavors.

On the day when Drega's paper ran a two-page story on Phillips' architectural mastery and gave details of the new city, Phillips began to wonder whether Gamble's civilization was as perfect as, say, his own city plans. There were annoyances. Phillips was not a grasping man, but it had been something of a let-down to win the third consecutive architectural prize and realize there was no greater reward than glory. He had the reputation and glory to start with.

For that civilization, a very peculiar thing happened to Mr. Phillips as he read Drega's glowing account the third time. He suddenly thought of the vast opportunities for an architect in Drega's world. Here, everything was so nearly ordered that any architect could supply requirements. But over there—ah, there were problems and dangers of building! There, it was the old grim battle to get a building up, something a man could get his teeth into and tussle with.

Phillips realized this was the battle urge and that gland 2207 must be over-secreting. A second very peculiar thing happened. He did not take the required gland balancer. He rather enjoyed his imaginative thought of danger and difficulties.

A month later Phillips went to Drega's. He had let his diet go to the devil lately, and he was filled with toxins making him outrageously old-world drunk. He was also contented.

He said to Steig, "I'm sick of perfect system. I want some excitement! I want to know again that a crummy architect may get my job because somebody likes him. I want to see my building going up with bum materials and have the sport of getting them by the building inspectors. I want to fight to get materials ahead of some prior order, and scheme to get some city ordinance overlooked."

Steig said, "You're sick, Phillips."

But his own mind began to work. "It is sort of quiet around here, though. Gosh! I remember back in the old Stevens plant it was so noisy you had to yell. One day I miscalculated a cylinder expansion on a test model and it damned near blew the plant up."

He never miscalculated now. He had a machine to do his calculating for him.

Phillips said, "Well, I'm leaving. I hope Gamble understands."

"He'll make a case study of your diet," said Steig sourly. "That's all it will mean to him." Steig was silent a moment, then abruptly, feeling like a runaway boy, "I'm going with you."

BUT THESE were scattered cases, unnoticed in the ponderous onward march of that highly geared civilization. The men's brains were missed—not the men.

During these days, serious supply problems kept Gamble at his laboratory in search of substitutes. If he had been out he might have heard and worked out a scientific solution. But even in his laboratory, certain monthly figures might have told him something was amiss.

The birth rate was up thirty percent from the previous year, and seventy percent from five years before. This was not due to family desire. It was due to sheer boredom. There was no longer danger and stimulus to life. The public was fed up with itself. There was plenty of amusement—which the public did not attend very heavily. And there was a growing clamor against Gamble. What did he expect them to do with their time? He should provide something to stimulate their desires!

Gamble had thought that, with the reduction of lower scale work, the people would turn to more play and relaxation and study to climb into the upper brackets. But not all men are born with the desire to climb into upper brackets. Many simply wish some work they can

do well and keep occupied. Others—many such had come—want only to be fed.

The laborers were always squawking on principle, of course, but it was the artisan who first felt fear of the new civilization. Forge men sat on comfortable seats and watched iron claws and mechanical contrivances do their work for them. The plastic molders put three-dimensional photographs in a frame and smoked while the product was being molded. Rumplemeyer sat in a glass turret of a vast glass factory and touched levers and buttons which ran the entire place. There were three other men on his shift. Two of them never saw a bit of the material or product!

"Salter would not have liked this," Rumplemeyer grumbled. "How can you know a product is good when you don't handle it?"

The product was good, but his thought was sound. The civilization behind the product was crumbling because men did not have a personal interest left. Men grew subconsciously jealous of these machines which had stolen their work. Hazily, they felt that perhaps Man was not born *not to struggle*. They felt the importance of being important. What did they mean here? They were not even important to themselves.

IT WAS a small thing which brought matters to a climax. Four consecutive months the production of the colored enamelware had been thrown out of kilter by unexplainable demand for the product. All production was on a basis of a careful study of public needs. But in this one item, the surplus had been wiped out and there was a clamor for all the enamelware available.

An investigation disclosed that Ross, the city comptroller, was hoarding. This brought out that he was holding five additional jobs, under various names, and using the credits of those jobs for

his peculiar acquisition. He had no use for the hoarded treasures; the product was not even valuable. Yet he was working eighteen hours daily to support his quirk.

He was an invaluable man, and every effort was put into his glandular treatment. His diet was changed. He was treated with short waves. He was cured.

But somehow—his brilliance was gone. He still did a good job, but his genius for probing out unsolved problems had disappeared. They had taken away his stimulus in life. Ross was smart enough to realize what had happened and to resent it.

In the big laboratory which crouched above the city, those were hectic days with vital supplies reaching an end. Tension was high, and in controversy Gamble snapped at a small fault of Ross'.

It was Ross who gave Lucky the story of the terrible shortage of sulphur and vanadium which was driving Gamble's civilization into veritable bankruptcy. Sulphur for acid—vanadium for catalysts and special steels. It would be a terrible bankruptcy for those who depended upon Gamble's civilization, for it would fall like a knife, unexpected. And upon the breaking down of a single unit of that complex machine, the whole structure would tumble.

Nor was there any way of borrowing for these people. Gamble was accused of having broken down the economic systems of the world. Outside of his own territory he was hated. None who lived under him could expect compassion or help from people who were still struggling for bare existence.

Lucky, galled by another outburst from Lulu Belle, broke the story in screaming, dramatic headlines over the television that night. He spoke only of the shortage faced by the nation. But the people concentrated their fear and hatred on Gamble.

It was recalled that once before this man had nearly wrecked the world with his talk of cheap gold and cheap wheat. Word leaked out from the cold, abstract theoreticians that he was responsible for the world's suspension in time. The masses had only vaguely suspected that—had half thought that, possibly foreseeing what was going to happen, he had simply protected himself.

Wild with the frenzied fear of people who can no longer stand alone, they rushed to his laboratories, thirsty for his blood. Not that he had given them this something-for-nothing world, but that his failure was taking it away—that was in their minds.

GAMBLE could have protected himself, beaten them into submission by cutting off their food supply and touching the city's master switch. But he was not wise in the ways of human nature. He still believed in cold logic. He went down to meet the people and explain.

They would have ripped him to shreds, had it not been for Prescott. Every one of them had lost people dear to them while they went on living. They were shouting it against him now. But Prescott knew human nature and the power of tradition. There were no courts in this new civilization, only hospitals and clinics. Yet the masses still had respect for the old laws.

"A trial," Prescott called upon the mob. "He is entitled to it under the Constitution!"

There was a pause in the mob's heat. "Get Drega!" Prescott snapped softly at Lucky. Then mob hysteria blazed up again, blazed doubly high as the artificial controls of the body toxins were smashed through.

Drega got there as the mock trial was almost at an end. He roughly pushed a path through the crowd and mounted the seat of knowledge.

"I will be judge," Drega roared. "This will be a trial by jury—you, citi-

zens, are the jury. Van Wyke, take Gamble's defense."

The crowd was beaten and bullied and overridden by the builder. They feared him now more than ever before. He was strong and lean and healthy. He glowed with a fierce animal spirit they had almost lost. Here was the man they had not followed. But he had survived, and across the river he had reared a city greater than theirs. True, it was not comparable in scientific ways. But neither was he faced with extermination because of the needs of that science.

"By what right do you condemn this man?" Drega asked.

They could not hold Gamble responsible for a civilization of their own making. They picked the older charge, the guilt of throwing mankind into suspended animation and the millions of deaths which had resulted.

It was a grave, gruesome charge and the arguments ran high into the night. Van Wyke waited until the opposition made it clear that they accused Gamble of mass murder.

"Where," asked the jurist in a quiet voice, "are the corpora delicti?"

There was a moment of silence, then an enraged outburst from those who would hang Gamble. The bodies had disintegrated, of course, in three thousand years!

Van Wyke gave forth an eloquent defense. How could a man be accused of murder of people who would not exist if they had lived normally? Suppose the world had gone ahead without suspension of life. Would any of these called murdered be alive today? "He killed no one—instead, he gave you life three thousand years beyond your time!" Van Wyke thundered.

"That's legal side-stepping!" somebody called.

Van Wyke said, "Law is law. This is deeper than the life or death of one

man. This reaches the very roots of civilization!"

Drega called out, "Will you commit mob murder or give this man his rights?"

IT TOOK all night and much more talk for that decision which gave Gamble his freedom. He had raised many to mighty power in the sciences, many who were jealous and would have liked to see him gone. At sunrise, an emotionally exhausted people gave him his freedom and turned home. But first, Drega promised to take them into his community.

Drega and Van Wyke took Gamble home. He was a tired and disillusioned man. Without thinking, he ate a chicken leg and drank some milk Drega offered him, his first normal food in many years.

"How have you done so well with nothing, and I so badly with so much?" he asked Drega.

"Well, Simon," Drega admitted, "we haven't done so well. In fact, if someone doesn't straighten out some electrical technicalities for us, and give us a chemical to fight the locusts, the whole country's liable to be in your boots."

"Oh, locusts," Gamble said reminiscently. "There was that gold gas we perfected once, but it was too expensive. We have plenty of gold if you want it."

Drega said, "We might buy it, but you don't use money, do you?"

"What is your money now that gold is gone?"

Drega grinned and winked at Van Wyke. "It's a little embarrassing. We haven't decided yet. I've simply issued 'prods'—promises to pay something when a monetary base is decided. It's rather difficult to find one with you transmuting all over the map, slashing working hours and skyrocketing production."

"You might set man's mental output as the base," Gamble suggested absently.

He was too tired to be angry any longer.

Drega said, "Well, that would be all right, but I have no output myself. Now if I had you to represent my capital so I could pay my debts——"

Gamble suddenly came awake and stared at this man who had been both his greatest friend and most bitter enemy. Well, why not? Apparently people did not know what to do with complete freedom from responsibility when they got it. He, who had given them so much, had nearly been slaughtered. Drega, who would sweat them to death, got their respect. Or at least their fear and obedience.

Gamble nodded a bit unhappily. "All right, Vincent. I guess my attempt at progress was a great failure."

Drega signalled for a bottle and clapped him on the shoulder. "Simon, it was the gesture of the ages! It saved the world from itself. We can have progress now. We can really build—together!"

HE SCRATCHED his chin reflectively. "By the way, that sulphur, vanadium and sulphate you wanted is all waiting over at Bayonne."

Gamble said, "How did you know?"

Drega grinned, "It was my agents

who wouldn't give it to you."

Gamble chortled into his mug of whiskey. Scientifically speaking, Drega was an exceedingly great sinner, God bless him!

Drega spoke again. "That jensen you wanted is also over at Bayonne."

Gamble said, "How did you get it? I offered him any kind of barter and he turned me down."

"He wanted too much," Drega said. "We thought in the interests of the people we just better take it. I'm not certain of the details. I believe he made it a bit difficult. But he was defeating the inalienable rights of the people to pursue happiness or something."

Van Wyke said piously, "God rest his soul!"

"Of course, we'll have to thrash out our views on money," Drega was saying.

But Gamble was already lost in thoughts of locusts and the great things to be done. Running the world was a full time job in itself. And a disagreeable one. It interfered considerably with more important work, the work of progress.

Lulu Belle was saying to Lucky, "Well, you'll have to find something that's as valuable as gold was. I'm not going to wear a bottle of whiskey for a wedding ring."

THE END.

One of the year's best novelettes

"Rule 18"

by Clifford D. Simak

Coming next month

IN TIMES TO COME

THE cover next month is going to be rather unique—a spaceship cover, but definitely different. It illustrates a new story by one of the oldest and greatest favorites—Ray Cummings. "Voyage 13", and a yarn that merits the cover.

EVERY editor eyes joyfully an outstandingly good story coming from a brand new contributor. I thought, for a while, I had one, though it did seem too darned good a yarn to be done by a completely new man. Clifford D. Simak. It took a little while to place the name—then I remembered. It's been a long time since *Astounding* heard from him—six years. But his story then was good, and his new yarn is even better. His story, *Rule Eighteen*, is, I think, one of the outstanding novelettes of the year.

OUR other novelette is another of Ross Rocklynne's interesting problem yarns. This one—*The Man and the Mirror*—gives as interesting and sound a physical problem as did his *Jupiter Trap* and *The Center of Gravity*.

BUT I can't name all the stories. There'll be the conclusion of Jack Williamson's *Legion of Time*—perhaps the best of the three parts. Kent Casey of *Flareback* and *Static* is back with a yarn *Good Old Brig!* That's told with the reality for which Casey has shown a unique ability. Raymond Z. Gallun, Warner van Lorne and Clifton B. Kruse will be there too. And L. Sprague de Camp has an article—a totally different kind of article on an interesting and unusual subject, told in an amusing way.

The Editor.

THE ANALYTICAL LABORATORY—APRIL ISSUE

- | | |
|--------------------------|------------------------|
| 1. Three Thousand Years! | Thomas Calvert McClary |
| 2. The Faithful | Lester del Rey |
| 3. Jason Sows Again | Arthur J. Burks |
| 4. Hyperpilosity | L. Sprague deCamp |
| 5. Iszt—Earthman | Raymond Z. Gallun |

The first four places were hotly contested all month. At month's-end, Three Thousand Years! was only 8% ahead of Hyperpilosity—and Hyperpilosity had but one dissenting vote! And—again a new-comer ranks among the highest.

WITNESSES OF THE PAST

by
Willy Ley

A science article about animals that, living today, are almost-unchanged representatives of species that have changed unrecognizably in intervening geologic ages.

THE level plain stretched beyond the horizon. It was like a gigantic carpet of high, green grass with an irregular pattern of bushes and occasional small forests. A small river wound its way across the plain, coming from the mountains in the north. When the sun shone brightly, the waters of the river were pure and clean. But occasionally, especially during the rainy season, it was of a reddish color. Then the river carried a large volume of water and with it countless tons of particles torn from the *Terra rossa* of the mountains in the north. In places the river had dug a canyon in the soft ground.

Two giraffes suddenly rose from the cluster of underbrush and approached the trees of one of the small forests. The voices of monkeys protested furiously, but they neither disturbed the giraffes nor the grazing herds of zebra-like animals and antelopes. A couple of large hyenas moved silently through the high grass; they knew that one of the numerous elephants was dying somewhere in solemn loneliness.

Suddenly they stopped. There was a smell in the air they did not like. They began racing with the wind that had brought this smell to their nostrils. Al-

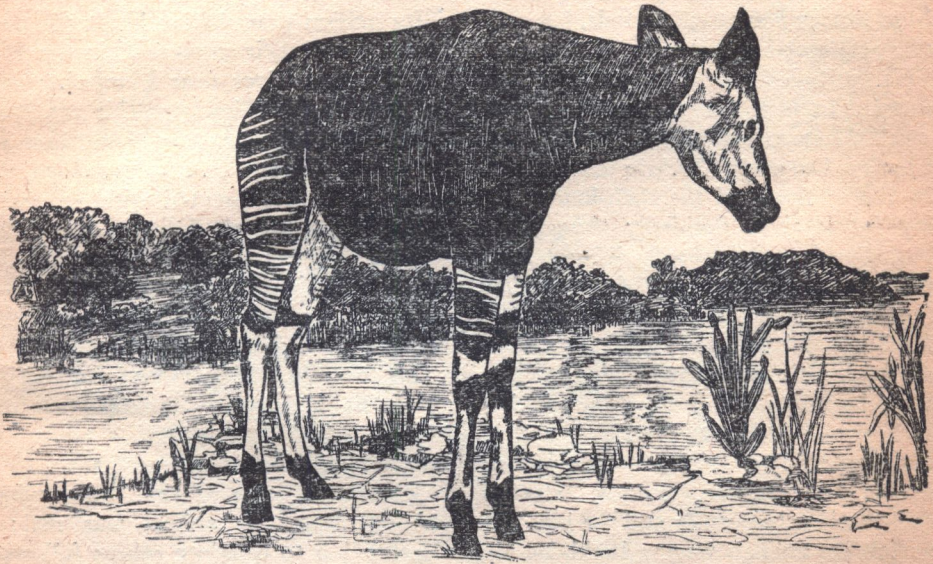
most simultaneously the other animals began to show signs of nervousness. Wide-open nostrils probed the air, then the ground vibrated under the clatter of galloping hoofs. Hordes of elephants with four tusks came thundering along, wild hogs, giraffes, antelopes, zebras and wild horses. There were large animals looking somewhat like giraffes, but with a short neck and with forelegs not quite as long as those of their long-necked cousins.

All these animals were racing away from a smell—a smell that told them that the grass was burning. They raced away from the flames. Some were caught, but not many. The others arrived at the river, in furious haste they crossed it and were safe. But a large herd had arrived where the river formed a canyon. It was not a large canyon, but too wide to jump across. There was no time to climb down the steep banks; others were pressing from behind. The animals jumped and died; the river buried them—

Seven million years later men came. They named the river *Megalorherma*; they called the remains of the mountains by the name of *Pentelikon* and they founded a village near the river and

called it Pikermi. Again, many years later, other men came to this country which they called Greece and began digging for ancient bones in the bed of the ancient river. Among the animals they found there, a type of short-necked giraffe abounded. They named it *Hel-*

it was a large variety of antelope, but when the animal was actually discovered (in 1900) zoölogists were utterly surprised. This "new" animal which the Negroes had called *Ndumbe* proved to be a short-necked cousin of the giraffe, related to *Helladotherium* and *Samo-*



The OKAPI: a survival of a past geologic age. Related to the more "modernized" giraffe, this zebra-like animal is directly linked to the long-extinct Helladotherium and Samotherium. The ears are large—but they work. The animal is shy, and extremely alert. Living in a particularly inaccessible part of Africa, it is difficult to reach the country, much more difficult to approach the animal. This alertness and shyness are, probably, part of the reason for the continued survival of this witness of long-gone geologic eras.

laddootherium, the "Mammal from Hellas".

Again, a few decades later, explorers came back from Africa. They brought pieces of skin with them which they had traded from the natives. The skin looked similar to zebra skin, but it was decidedly *not* the skin of a zebra. The natives claimed to know the animal that furnished this type of skin. It was, they said, large and extremely shy, and lived in places almost inaccessible to the white man. At first it was believed that

therium that lived in Greece at the beginning of the Pliocene period.

Okapi became the name for this living animal from the Tertiary period, and thus a new name was added to the growing list of "living fossils"—the most interesting and most fascinating list of animals known.

Ten years after the discovery of okapi, an expedition led by Adolph Frederic, Duke of Mecklenburg, investigated its habitat and found a landscape surprisingly similar to the Pliocene landscape

reconstructed by paleontologists and based on the fossil beds near Pikermi. It was actually a "Lost World" that existed almost untouched in Inner Africa.

THE DISCOVERY of the okapi came at a time when science was not only used to the thought of survivors from former geological periods, but actually welcomed discoveries of this type. This attitude was then comparatively novel. In fact, matters had been very much different before the publication of Charles Darwin's "Origin of Species" in 1856. Some of the then-known living fossils were decidedly shunned by bewildered scientists who did not know what to think of them. At that time, the "system" of the Swedish scientist Karl von Linné prevailed. It divided all living beings into two "kingdoms"—animal and plant life. The animal kingdom was divided into *vertebrate* and *invertebrate*. The latter are those without a backbone—clams, squids, starfish, cockroaches, butterflies and the like. The vertebrate animals have a backbone and ribs, usually a skull and legs of some sort. They were divided into the classes of Fishes, Amphibians, Reptiles, Birds and Mammals. The whole system was nothing but a classification of creation—unfortunately governed by the dogma that living forms never change.

The system itself was very helpful; it was the dogma attached to it that caused worries. Furthermore, Linné knew nothing of extinct animals and had not provided for them. For a number of years things worked out nicely. Then discoveries of extinct animals were reported in quantities; Cuvier in Paris started his work. Still it did not bother zoölogists very much; they simply did not care about the extinct monstrosities. Trouble began when living fossils—this term was invented many years later—were brought to the attention of the zoölogical masters. The most important one of these annoying animals, "set

across the path of the scientific method to show its worthlessness" (as Lesson wrote in 1839) was the *platypus* from New South Wales. *Platypus* proved to be not only annoying; it simply was Zoölogical Nuisance No. 1.

It came from a continent that had separated from the rest of the world about fifty million years before herds of mammals found their graveyard in the Megalorheyma River near Pikermi. Consequently, the animals of this continent were infinitely stranger than those of primeval Greece. A zoölogist of the year 1800, if presented with an okapi, would have had no difficulty in placing it in the system. But Dr. George Shaw of the British Museum did not know what to say about the animal, the skin of which he had received from Australia. This was in 1798. One year earlier *platypus* had been discovered—"water mole" it had been termed, a name still surviving in Australian vernacular.

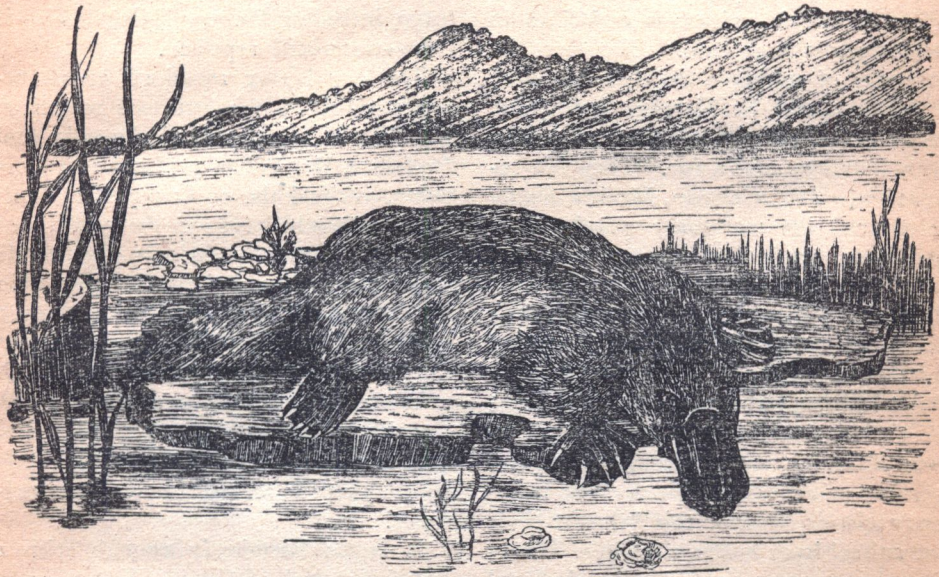
Shaw had a hard time to convince himself that this animal was real; a harder job to convince others followed. *Platypus* did not seem real. Furthermore its skin had arrived with a ship that had sailed the Indian Ocean and these ships usually brought strange pieces of Unnatural History. "Jenny Hanivers" came with them, skates and rays skillfully "operated" upon and dried as to resemble sea-monsters and dragons. "Eastern Mermaids" came, fore-parts of monkeys sewn to hind-parts of large fish. *Platypus* looked like one of these impositions, with its queer broad bill on a body looking somewhat like a small beaver. Careful study convinced Shaw that the animal was no imposition. He had to recognize it, and gave the scientific name of *Platypus anatinus*. Soon afterwards it was found that "platypus" was not permissible as a generic name, it having been used in 1793 by Herbst for a genus of beetles. Meanwhile the German Blumenbach, who had also received a skin from

Australia, had called it *Ornithorhynchus paradoxus*. The latter name is still in use, although *Ornithorhynchus anatinus* is recognized now as official and correct.

Both descriptions, based only on skins, necessarily omitted the features that made *platypus* so famous and caused a

very day nobody knows with any degree of certainty *why* the males are thus equipped.

IT WAS the anatomist, Home, who made the bewilderment of his colleagues about this animal from far off Australia



PLATYPUS: *the greatest annoyance to zoölogical science ever discovered. Origin of headaches among naturalists for a generation, it absolutely refused to fit into any existing category. It had fur like a mammal, laid eggs like a reptile, had webbed feet and a bill like a duck, and no discernible mammary glands. Its tail is mammalian, and its habits reptilian. It thoroughly and completely confused naturalists. Their first reaction was to put it down as a bad dream, for its skin (which was the first appearance) came on the same ships, from the same regions, that produced "mermaids" and similar miraculous crosses between monkey skins and fish tails. Certainly platypus seems to be constructed in Nature's spare-parts department. For years, the more they learned about the beast, the worse confusion became.*

controversy lasting almost a century. Shaw mentioned that the hind legs showed six digits, the sixth resembling a spur. He did not know then that it *was* a spur, that this spur is connected with a special and mysterious gland, that only the males have the spur, that it causes extremely painful and even dangerous wounds, and that up to this

complete. He discovered that the female lacked uterus, mammary glands and nipples. He found that the oviducts, instead of uniting to form an uterus as it is customary with mammals, opened separately into a cloaca as if the animal were a bird or a reptile!

Up to the time that Home published his report, zoölogists had contented

themselves in declaring the *platypus* a somewhat queerly built mammal. Now, with mammary glands, nipples, uterus and all the other things that make a mammal what it is missing, they wished fervently that it had never been found alive. They were almost ready to believe Sir John Jamison's statement: "The female is oviparous and lives in burrows in the ground." But then the majority of scientists decided that such a belief would be blasphemous. One could not admit the existence of a bird with four legs and a fur. They felt relieved when the German, Meckel, finally discovered the mammary glands; they had been overlooked because they are large only periodically.

Meckel's discovery, however, greatly upset the theories formed and advanced by the two French scientists Geoffroy Saint-Hilaire, father and son. The Saint Hilaires insisted that a special class be created in the system for *platypus* and possible relatives, and did not like mammary glands because this brought their pet animal back to the mammals. Therefore the younger Saint Hilaire declared that the glands must be scent glands and asked Meckel, maliciously, how he expected the billed young *platypi* to suckle milk from glands that did not even have teats! Meckel was right, however; the glands were actually milk glands. Nobody could guess that the mother is lying on her back when the young ones are feeding. Since nobody could make this guess, the Saint Hilaires did not get a good answer at all and felt elated. They loved the persistent reports from Australia that *platypus* lays eggs. They even published pictures of these eggs. Unfortunately, drawing and reproduction were so excellent that experts could classify them as tortoise eggs without any difficulty.

Meanwhile Darwin's first book appeared on the market, and even if it did not at once convince the majority of the learned world, its theories were consid-

ered by everybody. They could explain the mystery of *platypus*. Darwin claimed that the mammals had once evolved from the reptiles. *Platypus* apparently demonstrated how the "transition stage animals" had looked. The fur and many other things were already mammalian; the cloaca and other features, including the egg laying habit—if true—were still reptilian.

The egg laying remained an uncertainty until 1884 when two scientists, Dr. W. H. Caldwell of Australia and Professor Dr. Wilhelm Haacke of Germany, verified the early reports. Both found unhatched eggs in the pouches of females. Curiously enough, they made their discoveries independently within the same week without knowing of each other and announced their discoveries the same day in two different places!

While the scientific battle about *platypus*, its life habits, its classification and its significance was still raging, Australia yielded another zoological nuisance.

It began harmlessly enough with a question asked of Gerard Krefft, curator of the Museum of Sydney, by one William Forster who had lived for many years on a farm near the Burnett River. Forster asked about a certain large fish. Krefft told him that he had never heard of it, and Forster assured the curator that he would "get him some". His cousin, who still lived on the farm, caught a few of these fish and sent them to Sydney, preserved as well as possible with much salt in a sturdy barrel.

GERARD KREFFT opened the barrel and spread the "new fish" on the dissection table. It was about five feet long, looking in general like a big, fat eel of greenish color, with large scales. Unlike real eels, it had four strong and powerful paddlelike fins and a tail which was unlike any other fish tail ever seen. The scientists had names for them because they existed in theory. The term

for the paddlelike fin was *Archipterygium Gegenbauri*, while the tail was a *diphyceral* tail. It would need a book to explain the full significance of these terms. As an approach to the full meaning, it may be said that Professor Gegenbaur's theoretical *archipterygium* represents the most primitive fin possible, having a skeleton resembling the structure of a fern leaf, while a *diphyceral* tail is no tail at all but simply a rim of fin material around the end of the spine.

This was surprising enough, but more was to come. Kreffit opened the mouth of the fish and looked at its teeth. What he saw made him feel as if he had accidentally touched a Leyden battery. (There were no high tension wires in 1869 when this happened.) Teeth of this type were known, but only in a fossilized state. The great Agassiz himself had named them; *ceratodus* he had termed the fish to which they once belonged. It had been uncertain what type of fish the *ceratodi* had been—possibly sharks it was thought, possibly something else. They were something else. Kreffit had the opportunity to find out. He dissected the fish. If he had still been capable of feeling surprise, he would have felt it again. The fish had gills as all other fish have. But in addition he had a *lung!*

Two lung-fish were already known at that time. One had been discovered in 1833 by the Austrian collector Johann Natterer in South America; it had been termed *Lepidosiren*. A few years later a cousin of *Lepidosiren* was found in the White Nile, the name became *Protopterus*. Both had lungs with which they breathed if they were forced to live in foul water. And both survived the dry season in a state of suspended animation in round mud-cakes. These mud-cakes can be shipped by mail without extra precautions except waterproof wrapping paper. When the package arrives at its destination, the mud-cake is placed in

lukewarm water, and a few minutes later a healthy—and also hungry—lung-fish emerges.

The new Australian lung-fish—Kreffit termed it *Ceratodus forsteri*, later the names *Epiceratodus* and *Neoceratodus* were used to distinguish the living form from the extinct *ceratodi*—surpassed the two others from the Amazon River and from the White Nile. Not only in size, but also in age. *Ceratodus* was a real survivor from periods even older than the origin of the mammals.

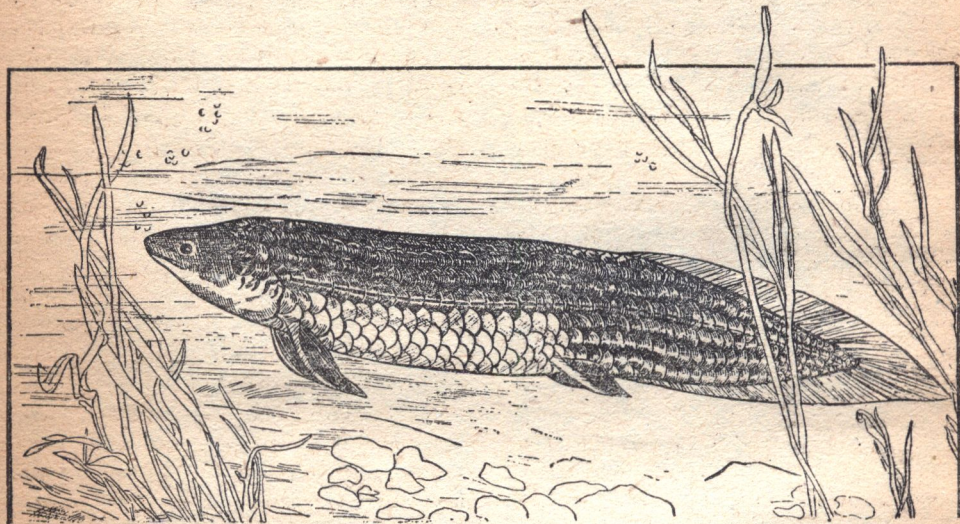
There exists a rule that the individual development of an animal reenacts in somewhat shortened form the evolution of the species. Everybody interested in paleontology and evolution was eager to know what material could be gathered from *Ceratodus'* individual development. Professor Ernst von Haeckel, of the University of Jena, was especially eager to know it, for he was not only the fiercest warrior of evolutionary ideas, but also an emphatic defender of the rule mentioned. Australian scientists were much too slow—in his opinion—to furnish the data desired, and so he dispatched one of his pupils, Professor Richard Semon, to Australia.

Semon's expedition, successful as it eventually was, is a novel in itself. He arrived in Australia in August 1891. At first he was directed to the wrong place. He did not find *Ceratodus* there, but was lucky enough to get more reliable information and to correct a few minor mistakes made by Kreffit. Then he went farther inland and established himself many miles from the nearest settlement, directly on the shores of the Burnett River, and waited for *ceratodi* to come, and to lay eggs. *Ceratodus* did not arrive so quickly, but a human visitor, Professor Spencer from Melbourne, came. He was going to spend his vacation on research. The objective of this research? Oh, he just wanted to find out something about the individual development of *Ceratodus*. Dr. Caldwell

(the same who had discovered that *platypus* actually lays eggs) did not have enough time; he had only found that the fish places its eggs on the stalks of greens growing in the river.

The two professors shook hands and tried to work together peacefully. But

of science they caused, had caught the fish and tried to satisfy their proverbially insatiable appetites with the meat. Semon lost his temper and began to shout. The next morning he discovered that he was alone in the wilderness; the natives had simply disappeared. Then the rainy



CERATODUS: the Australian Lungfish. Australia's second triumph of zoölogical confusion. About five feet long, it resembles a fat eel, which is all right, but it also has paddlelike fins and a tail that's all wrong. It isn't a fish-tail, and it certainly isn't an eel-tail. Furthermore, the best way of shipping the fish alive is to dry it out in a cake of mud and keep water away. An African relative sadly confused naturalists who tried to catch it alive and transport it from its native lake in a tub of water. The fish invariably drowned. Natives showed how it could be done; carry the fish in a wicker basket and they live comfortably. Caked in dried mud, the lungfish have an incredible vitality. They survive a concentration of metabolic poisons accumulating in the blood so great that a tenth or twentieth of the concentration would be almost instantly fatal to any normal creature.

there was nothing with which to work. No *Ceratodus*, no eggs. Spencer at last had to go back to Melbourne; Semon stayed on. A full month after Spencer's departure, a few eggs were found, Semon began to work. The greens of the river were thoroughly investigated, but suddenly the supply of eggs stopped. The natives, unaware of the frustration

season began and Semon knew that he had to wait for a full year.

Everything seemed wrong. No results, rainy season, vacation almost, and funds completely, exhausted. He began to send telegrams to Europe. The requested funds were granted, the requested extension of vacation also. But he was still in a very gloomy mood when

he went to Thursday Island to use the time at his disposal to make a number of less important observations and studies. Hardly more cheerful, he returned to his camp, determined to finish the work regardless of a malevolent fate.

Suddenly everything went well. *Ceratodi* came and laid eggs in large quantities; natives obeyed orders even if they did not understand them completely; friends and colleagues took care of the young *Ceratodus*, preserved them in alcohol at the various stages of development, and shipped them to Jena after Semon had left Australia. Working on these specimens, the evolution of *Ceratodus*, the mysterious survivor from a forgotten age, could be traced, and science received a clear picture of how aquatic life had developed into land forms hundreds of millions of years ago.

NEW ZEALAND, separated from Australia by the Tasman Sea, could never hope to compete with the fifth continent, if it were not the home country of a very strange lizard. Although it seems as if New Zealand was separated from the rest of the world a little earlier than Australia, it preserved neither lung-fish nor *platypus*. There is a strange, wingless bird living in the forests, the kiwi, and a tiny crab in its mountain lakes which is also a survivor from the age of reptiles. Otherwise, there is no primeval fauna to be found. Once, when mysterious tracks in the snow covering one of its numerous mountainsides were found, scientists had some hope of discovering a surviving primeval bird, a veritable *Archaeopteryx*. None less than Charles Darwin himself urged explorers and settlers to be watchful for such a rare specimen. But nothing was ever heard again of these tracks and of the animal that caused them.

Still, New Zealand is one of the important countries for surviving witnesses of the past or, rather, for one of them.

On some tiny, rocky cliffs near the South Island there lives a lizard about two feet in length. It is of dirty olive-green color, and does not look very extraordinary on first sight. Only its comparatively large head and eyes make it somewhat conspicuous to the casual observer.

But when this animal was dissected for the first time by a skilled anatomist, he felt something that could only be compared to the emotions felt by Kreffth when *Ceratodus* was under his knife. This lizard, called *Tuatera* by the natives and *Hatteria* by the scientists (*Sphenodon* is now the official name) offered an anatomical puzzle that needed quite some time for solution.

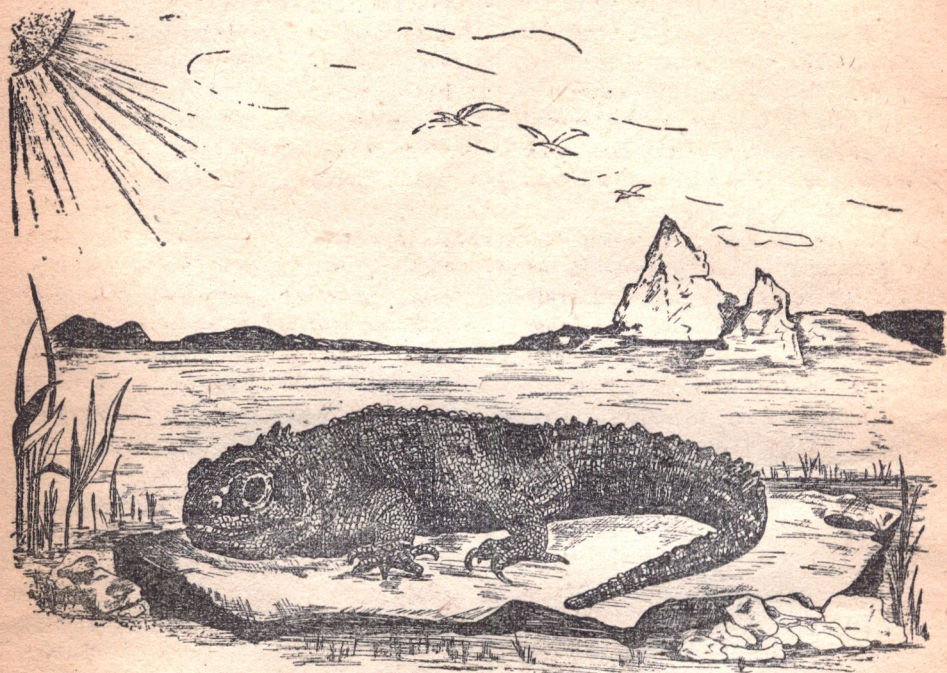
In general build, it was a lizard. But there were several anatomical features that, looked upon separately, made it a snake. Then a few facts were discovered that made it look like a turtle. Some reminded of crocodiles, and some even faintly suggested birds. Although it was not most important, it was most conspicuous that this lizard showed a remarkable development of the third eye. Rather, its third eye was much less atrophied than the third eye of other animals known at that time. (Later equally, or even better preserved, third eyes were discovered in the skulls of the Galapagos leguans, and of a small, footless lizard living in Germany, the so-called *Blind-schleiche*.)

If these discoveries had been made fifty years earlier than they were, they would have angered the scientist who made them. As matters were, everybody who saw them was excited. "There is a real saurian alive on the cliffs of New Zealand," the reports said. "Not one of a large size to impress our emotions, but one of so incredible an age as to stir our imagination. This seemingly unimportant little lizard is not only a saurian in the usual meaning of the word, but it is an ancestor of saurians. It is actually a survivor of a group of reptiles that formed apparently the

root group of all other reptiles during the period known as the Permian."

This was really big news, but later some of the enthusiasm had to be cancelled and a few of the statements had to be withdrawn. *Sphenodon* is actually

left. It is true, however, that *Sphenodon* saw Earth's history since the beginning of the age of reptiles, and that it actually belongs to the ancestors of some very impressive extinct saurians, among them the *plesiosaurs* that were such an



SPHENODON: *New Zealand's contribution to the list of zoölogical headaches. Sphenodon represents a period far more remote from the proper period of Platypus or the Okapi even, than those two are from us. This drab lizard has maintained itself against changing, hostile environment without great change since the dawn of the Age of Reptiles. As a result, it combines the parent traits from which sprang differing lines of evolution. It has, in consequence, characteristics that reminded naturalists of snakes. On the other hand, in some ways it is turtlelike. Also, it has resemblances to the crocodiles, while certain formations suggest the bird family. Sphenodon is zoölogical hash—a sort of unrefined ore of animal characteristics from which evolution gradually split off specialized reptilians and, later, the bird family.*

a surviving member of the *rhynchocephalia*, an extremely old group of the reptiles. They are, however, not the most ancient group as had been believed. This glory goes to the *Cotylosaurians* of which there is no survivor

outstanding group of marine life of the Jurassic and Cretaceous periods.

THE QUESTION is permissible as to which one of the living fossils is the oldest. This record does not go to the

lung-fish, as one might think, but to the sharks. They are known from geological periods so ancient that their age represents a staggering number of millions of years. Still, they are not the oldest. There are animals that lived even before the famous "armored fish" of the Devonian period, long before the first sharks made their appearance. The animal that might claim the record to be the oldest—at least one of the oldest—living fossil is the horseshoe crab (*Limulus*) of the Atlantic coast of North America.

One has only to look at it to feel that it does not belong in our time. It has only one pair of feelers (all real crabs have several pairs), it has a strange armor and an even stranger sting. There is copper in its blue blood and there are no mandibles forming its mouth. Several pairs of legs conveniently located

near the mouth hole do the work of shredding the food. If one is lucky enough to see a young horseshoe crab, one can almost believe he is seeing a living trilobite. There must be a direct and very close relationship between *Limulus* and the ancient trilobites. Somewhere behind the Carboniferous period, *limuli*, trilobites, insects, arachnids and centipeds merge with the crabs of today. It is disputed when, where and how, but there is no doubt that they all have a common ancestor. And *Limulus* must be relatively close to this ancestor. In fact, *Limulus* is, in one way, the most astonishing of all the living fossils. Okapi, Hatteria, *Ceratodus*, *Platypus* and all the marsupials survived in "lost worlds" of some sort. But *Limulus* managed to avoid all mutations for hundreds of millions of years in the open sea!

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MARS

Our second astronomical color-plate cover came this month because Manly Wade Wellman's story *Men Against The Stars* offered so perfect an opportunity for such an illustration. Very probably the first men to reach Mars will, in fact, make a landing on Diemos. From that vantage point, accurate mapping photographs of Mars may be made, using powerful telescopic lenses rather than true telescopes. For Mars is but 30,000 miles away.

And perhaps they will establish there on Diemos, a sort of base-camp. Tons of fuel, food and oxygen supplies might be deposited there to be picked up on the homeward trip, avoiding the necessity of dragging them up against Mars' gravity.

I thought first of having this color-plate illustrate Mars as seen from Phobos, the inner satellite. But not all of Mars is visible from Phobos! The tiny moon is so close to its primary that the curve of Mars' bulk hides the polar regions. So we chose Diemos as our point of vantage.

Those are not mountains in the foreground; they are bare, jagged rock. Diemos has no horizon, in the accepted sense. The little world is far too tiny (diameter 10 to 15 miles) to have sufficient gravitational pull to force rock into a rounded ball. Instead, it is probably a mass of gaunt, crystalline rock, dazzling where sunlight strikes the right angle, black as space in the shadow. But not black rock. Few rocks are black. Wesso has shown splashes of color—perhaps a vein of copper or cobalt or nickel salts staining the duller silicates brilliant red or blue or green. A trace of a chromium compound would give out a blazing color—and practically any color from deep red to brilliant violet. Or metallic gold might be present. Surely, with the immense variety of brilliant-hued minerals, there's no reason to suppose that Diemos must be entirely drab and colorless.

Mars itself is shown at late spring in the southern hemisphere. The northern polecap is still rather small, but glistening white with the accumulated hoar-frost building rapidly in the late fall weather. The vegetation of the northern regions is sear and brown, invisible against the red rust of the planet. The southern vegetation is springing and spreading. The long day has started at the southern pole, making it the garden spot of the planet, warmed by continuous, though dilute, sunlight.

And Phobos, the inner satellite, is visible in the picture. It is shown in near-correct magnitude, exaggerated only slightly—and exaggerated at that, to be visible at all. It is on a line with the equatorial region of the planet, directly between the *A* of *Astounding* and the small, printed legend below. That is a more-than-adequate representation of the light of one of the famous "twin moons of Mars"!



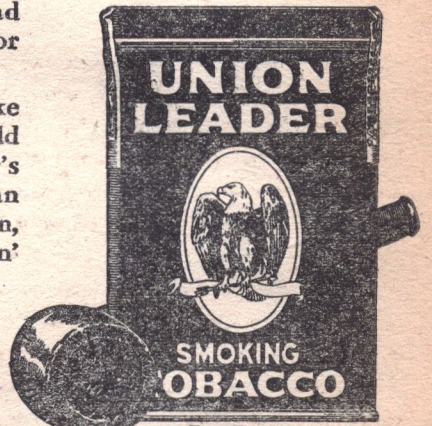
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SCIENCE DISCUSSIONS AND BRASS TACKS



Astronomical covers and Evolution.

Dear Mr. Campbell:

You want to know what we, the readers, think of the new idea in covers so here goes. The picture of the Sun as seen from Mercury is a splendid improvement over the old type. People not familiar with the magazine are apt to smile when they see the covers showing fantastic beings and machines. Probably they are reminded of the pseudo-science comic strips.

As to the cover picture: I know no one on Mercury would look at the Sun with the naked eyes or through clear glass, but if one looked through glass dark enough to see the sun-spots, as shown, would the corona be visible? But I suspect you have considered this and believe it likely that prominences of the height shown could be seen.

Am glad to hear you are going to continue this type of cover. A view of the Earth as seen from the Moon should be a fascinating picture. It might show the Earth illuminated half with sunlight and half with moonlight, with the glare of the Sun reflected from the surface of an ocean and the reflection of the half-moon on another ocean, if it could be seen. The white of snow would show in the polar regions and in the winter hemisphere, also, perhaps on mountain ranges in the summer hemisphere. Maybe there should be a slight difference in color between forest, desert and cultivated regions. Part of the surface would be obscured by clouds. The Earth as seen from space must be the most interesting object in the Solar System because of its oceans, clouds and seasonal changes.

Saturn as seen from one of its satellites should be a good subject, and how about some lunar scenery in its probable real colors? The Moon is one of the most-pictured extra-terrestrial objects, but after all, it is the closest and the easiest to examine and will be the first landing place for space travelers. My impression is that the apparent uniformity of color on the Moon is due to the conditions under which we see it. Yesterday it was cloudy—here but we could see

the snow-covered Sierra Nevada Range sixty miles away illuminated with bright sunlight. It had a silvery brightness curiously like a lunar landscape as seen through a telescope. There was the same lack of variety in coloring, yet in the mountains there is great contrast between the snow and light-gray granite and the green of the trees (pine, fir, cedar, etc.) and the dark, volcanic rock.

One more suggestion and a leap from a near viewpoint to one immensely remote. Would it be possible to picture the galaxy as seen from the outside? But I doubt that astronomers have yet accumulated enough information to form a basis for such a picture.

For the sake of variety I'll enclose a brickbat or two. Burks' "Fatal Quadrant" included a number of things I thought needed explaining. When the keystone is blasted out to "bring a mountain crashing down" where does it fall to? Are mountains supposed to have empty space under them like stone arches? The lost people were "taken suddenly—when the ice got them—they were caught just as they stood—not in twisted attitudes at all". Ice (or water) coming suddenly would wreck buildings, to put it mildly, not to mention the effects on the people. Elsewhere, it is stated that the ice accumulated very slowly.

Unless I'm much mistaken explorers have not deciphered the hieroglyphics of ancient races in Africa and Yucatan without trouble, as stated. They have done it through long years of hard work and sometimes with incomplete and not too satisfactory results.

John D. Clark's letter on the future evolution of man was good. At the risk of offering myself as a target for the "unlimited quantities of destructive criticism". I will offer a few comments. This picture of the larger, stronger men of the future is more cheerful than the usual idea of them as feeble-bodied and balloon-headed. But why say they will be only 6½ or 7 feet tall in 1,000,000 years? He gives the small size of the armor in the museums as his evidence that men were smaller when it was

made. I have read that the two largest collections of armor in the world include only one suit that would fit a six foot man so that's all right. But if the average height of a man has increased appreciably—say only one inch—in 500 years, what will it be in 1,000,000 years which is 2,000 times 500? Yea, verily, there will be giants in those days!

Another point: Isn't it very likely that if Man becomes able to "know the universe around him without the intervention of other senses"—develops what Dr. Rhine calls ESP or extrasensory perception—that those other senses will decline? In that case, Man will have less efficient eyes than at present, or may have merely vestigial remnants of them. ESP would not be hindered by lack of light, intervening objects, apparently not by distance, and one would not have to turn his head or focus his eyes. If such a sense ever becomes generally efficient, eyes will almost fall out of use as awkward and comparatively useless organs of perception.

Mr. Togue verbally thumps Eando Binder for making the statement: "When you decrease the speed (of an object), energy is again expended." In most practical instances isn't that true? It takes energy to apply the brakes on a locomotive to avoid hitting a cow, or to run the engines of a steamer in reverse to avoid smashing into a wharf. If a rocket-ship fires its forward rockets to slow up, energy is being used just as surely as when it fires rear rockets to speed up.

The length of this letter is a surprise to me but if you don't have time to read it I won't be surprised. I won't blame you either.—D. R. Cummins, 221 J Street, Sacramento, Calif.

*"To the biologists: Please stay away.
We're having a fine time now." per-
haps?*

Dear Mr. Campbell:

Will you permit me to entertain a few doubts about Mr. McCann's ideas on human evolution? His argument with Dr. Clark, presented in the April issue (backed by that of Mr. Reinsberg) seems to be centering around "deadly slow", which, one gathers from Dr. Clark, is such a rate that periods of the order of a million years must elapse before marked change is noticed. Mr. McCann, on the other hand, maintains that for man, changes will occur in a much shorter time—but fails to give any definite rate. A thousand or ten thousand years for appreciable change, Mr. McCann? Or a hundred?

The McCann arguments for the faster rate involve two points. In a single paragraph—if not in one breath—he "suspects" the age of *P. erectus* and then "holds" that the rate of evolution of a type speeds up as the type grows older. Whether this is true or not I don't know. I am no more of a biologist than is Mr. McCann. But I do "suspect" it until we are shown some reference that is at least semi-authoritative. The McCann Law (if we may call it that), while it may not be entirely false, is certainly not stated completely. We have only to look about us and observe his saurians which, "once they were under way . . . changed . . . and varied with astonishing rapidity . . ." Today the saurians are even older than they were in those bewildering times and accordingly we would expect even more rapid development. If there is any relation between rate of evolution and age of type, it cannot be that stated in McCann's Law—granting, of course, the correctness of his data on the rapidity of saurian evolution during their prime.

Mr. McCann's second point is that man's self-made environment will act as an accelerator, and he even brings in financial motivation for evolution by pointing out that the "amblops"

who can move and use his eyes independently of each other will be a more valuable workman, that extra dollars in his pay envelope will lead toward the perpetuation of this variation if it occurs. Now it has always seemed to me that our much maligned present-day environment is not any more pressing on the species than those of the past. Humanity has changed very little in six thousand years, and during all that time man has been confronted by environment, economic systems and emergencies but little less efficient than our own in giving us the "relentless, unceasing squeeze". Mr. McCann may quote statistics on the increase of nervous breakdown and heart failure, but we will still doubt—for can he give us any data on the prevalence of those disorders in Rome, Athens or Babylon? With the assurance that the diagnoses were as correct as those of today?

We can imagine other developments of man's senses and powers than those upon which Mr. McCann puts such a premium for continued existence in our age, developments which would be just as useful in past times. A hairy gentleman with a large club and a small brain who could see down into the far infra-red would have a great advantage over his fellows in that he would not be blind on a cloudy moonless night. A shorter reaction time would have been as valuable to the old-timer in jumping out of the path of a drunken prince's chariot as it would be to our modern pedestrian who has the advantage of a traffic signal system. An ambidexter should have some of the advantages of the "amblops", if he could control each hand simultaneously, but is there a noticeable premium put upon his services in industry?

Then again there is the delicate question—what is evolution? Things like the increasing height of certain peoples, their increasing longevity—are they to be called evolution, or merely changes due to better diet or more exact medical knowledge, reversible and controllable within certain limits by variation of those factors? This preferred individual in the McCann doctrine, with his shorter reaction time, his super-movable eyes and his taxed-to-the-utmost abilities—is he a true evolution product? Is evolution the sum of a series of such small changes, or does it also need a different, more drastic type of change? In other words, are such small modifications mutations?

It seems to me that the McCann thesis, while it may conceivably be correct, has no proofs. Since he has freely admitted already that he has no proofs we have come a long way with no gain. But in addition to having no proofs it seems most improbable, since the things he is expecting to hasten evolution have been with us for some thousands of years with no appreciable effect. This brackets his shortening of Dr. Clark's "deadly slow" process to between five thousand and, say, half a million years, which I maintain is *still* "deadly slow".

One thing may show up within the next hundred years, however. When mice are irradiated with X-rays in certain doses there is produced an effect on the chromosomes which may not show up for several generations—when the progeny start appearing with certain parts missing, jawbones or legs or what-not. During the past generation or two, people in considerable numbers have been working with, or exposed to, X-rays and radioactive radiations. More recently quite a few have been sprayed with neutrons and various amounts of a remarkable assortment of atomic debris. What effects may show up in the next few generations?

I certainly appreciate the McCann lapse into biology. One would hardly think of bringing any attack against him in his home ground of physics and chemistry. This evolution-of-man stuff should provide plenty of room for nice, high-sounding, unprovable arguments. At least until some biologist strolls in and points out that none of us knows what he's talking about. Even that won't be too bad. We've all admitted it already.—Robert D. Swisher, 15 Ledyard Road, Winchester, Mass.

Natural "law" represents best present belief.

Dear Mr. Campbell:

In reading the letters from various contributors to Science Discussions as well as Brass Tacks, I find most of them laboring under a terrific delusion. They seem to think that if any author defies a natural law or statement laid down by some scientist it is no less than sacrilege. It is nothing of the kind.

The true scientist regards no laws as being immutable or indestructible. They are only his tools—possible explanations of certain natural phenomena. The scientist has no reverence for his theories; he merely clings to them until he can find better and more suitable ones. Just because a certain John Dalton developed an atomic theory is no reason that there actually is such a thing as an atom. If conditions should appear which proved unexplainable by the atomic theory, it would immediately be abandoned for another theory. It is the same with our Solar System. It is not definitely known that the Earth revolves around the Sun. It is only the most logical hypothesis we can think of. In one way the scientist is lazy—he usually takes the easier way out of things.

However, I do not mean that all previous theories may be discarded with the wind like so much trash. If in a story any theory should be contradicted, there must be a logical, plausible explanation for it. By this I do not mean the nonsensical ramblings of certain thought-variant wizards (Yes, I mean you, Mr. Fearn). Most of them do not know a parsec from a positron.

Well, I hope I have given someone a little food for thought.—Edward Ludwig, 514 West 11th Street, Tracy, California.

Negative—energy electrons—old "ether"?

Dear Mr. Campbell:

Since every one with a smattering of physics realizes that it is impossible to perfect interplanetary communication under the present hypotheses of that science, it is probably a sinful waste of time to read your excellent magazine—but I greatly enjoy it. Especially "Galactic Patrol," although there were a few incidents unfathomable, like getting next to a ship that had its shields up.

It strikes me that your authors, physics being what it is, would welcome any new theory which would let them get into space without singing their tails. Yet most of them appear to base on physics from Newton to Einstein, and do not attempt to forecast future logical developments. I, myself, had only high school physics fourteen years ago, still I think I can help them out with what we shall call the "Bunte-Hayden-Dirac" theory. Let's go!

Dirac surmised an infinitely dense web of negative-energy electrons, I understand, which we can never see nor sense as such. (This brings echoes to my mind of the equally all-pervading luminiferous ether, with which we used to have so much trouble.) I theorize that this web of negative-energy electrons is actually the ancient "ether". To be sure, the ether theory supposed that the luminiferous media was extremely tenuous. I claim that it would have to be dense, because waves travel faster in a denser medium; i.e., sound travels faster in iron than in air. Also, an electro-magnetic vibration may have equal facility of travel although the energy levels are inverted. Cosmic rays are doubtless a by-product of change in light energy from one level to the other. Heavyside and other layers represent changes in energy levels.

Having raised plenty static with the ether, we now attend to the chief bugaboo of interplanetarians—gravity. In an infinitely dense and all-pervasive medium, how would independent bodies of a higher energy level react? Would they not be somewhat spherical, as a

bubble rising through water? Moreover, the units furthest removed from the levels of negative energy would seek the center, the elements with lower energy levels—that is, with fewer electrons—would seek the top. Of course, this presupposes that the inward push of the infinitely dense web is the force of gravity.

Well, I could go on adducing reasons; but here is enough for the boys to shoot at. Here's hoping that it's sufficiently illuminating, and gives the boys something to think about besides Atlantis.—Marshall J. Hayden, 641 Sierra St., Reno, Nevada.

Maybe the machines he uses and not Man himself will do all the evolving.

Fellow Hatchet Tossers:

And Arthur McCann in particular. I beg to differ with the present evolutionary concepts. Swivel eyes are a nice idea, but I doubt that man will get them naturally. In fact, it seems to me that man is stopping his evolution by those same machines you talk of. They are taking his place in the evolutionary process to such a degree that man's only natural change will be a subdued tendency toward longer fingers the better to work with.

Man's greatest progress will come through his effort to perfect his present evolutionary state as his ideal!

When will everyone find out about escape velocity?

To Paul Gaumond who so nicely criticizes Frank Bochick:

How do you reconcile your statement that light generated on a body moving faster than light would not trail behind the body, with J. J. Logue's quotation "the speed of light is a constant 186,000 m.p.s. regardless of the speed of the source"?

As for you Mr. Logue, what a lot you had to learn to get boozed so beautifully! Sound has a constant speed which varies as the medium and the temperature. Why not light? All our deductions so far have been fine reasoning from earth-bound facts done for us by a few people who could reason and did. Knowledge is power; intelligence is the ability to use it. Schools now do too much learning in proportion to the amount of reasoning power induced. When we get our first observations in wide-open space we may learn something.

As a parting evolutionary idea: perhaps far back in the past a race died out due to the fact that all their progeny were mutants—the new human being. And—we may be subject to the same disaster!—Dale Tarr, R. R. 2, Cloverdale, Ind.

Suppose we use both time and space travel stories?

Dear Mr. Campbell:

Why can't we have more serials written as well as "Jason Sows Again." Although I have been a constant reader of your magazine for about five years, I have never had the pleasure to read a serial that appeals to me so much as this one. Let's have more such stories by Arthur J. Burks.

The best short-story in your April issue was "Matter is Conserved", although "The Faithful" ran it a close second. "Three Thousand Years!" is fair, but I have read better. "Izzt—Earthman" and "Negative Space" were very well written, and supported by well chosen plots. I enjoyed them very much. How about cutting down on the space-travel stories, and putting time-travel stories in their place? I think most of the readers would agree with me if the question were put up to them.

I am putting the following in, in case this letter is published. I would like to correspond with readers of this magazine who live in the U. S. and Foreign countries.—William Wyatt Bell, 716 North 25th Street, Paducah, Kentucky.

Concussion rather than Discussion?

Dear Editor:

It was with considerable surprise and some apprehension that I noted the rather uproarious emergence of Brass Tacks from its well merited banishment to the limbo of obsolescence. Such a department could and should be of inestimable value as a symposium of the opinions and preferences of your readers—if all readers could be persuaded to present their mental reactions as opinions rather than pearls of wisdom from the treasure house of omniscience. Brass Tacks, for some time previous to its banishment contained more stridence than science, more concussion than discussion. It was about as interesting and instructive as a cacophonous wrangle between a covey of quail and a flock of crows; the quail perpetually interrogating "But why? But why? But why?"; and the crows raucously "Because! Because! Because!" And its short sojourn in the editorial hoosegow appears to have improved neither its temperament nor its technique. One of the most forensically ferocious Brass Tackers yet heard from, in the February issue, horrified a palpitating world with the devastating announcement that 99% of all science-fiction stories appear to be addressed to the mentality of high-school freshmen! The gentleman seems not to admire "the frosh". He must be a sophomore. That would account for his vast mental superiority. I remember when, some forty years ago, from a lofty perch atop my Sophomorean Tower of Babel, I smiled sardonically down upon a drab and mediocre world; and I marveled that human evolutionary development had, as yet, produced but one pre-eminently perfect mind.

And then, in the March issue, come the Gold Dust Twins of Jacksonville, Florida, endeavoring to house-clean science-fiction by expurgating one of its most illustrious contributors. They projected a double-barreled hurricane of vituperation, redolent with the aroma of decay from the everglades and laden with sour superlatives and other verbal debris, in the general direction of Dr. E. E. Smith and his phenomenal Boy Scout, Kimball Kinnison. The havoc wrought among indignant bystanders was terrific; but the ultra-perceptive Kim met the approaching storm with ever-ready DeLameters blazing. There was a puff of exploding gases, an indescribable stench of burning putrescence; then nothing remained save a tiny whorl of superheated air and a few turgid epithets such as "idiotic" and "insane" lying scattered about. Only an imaginary line divides insanity from genius; and our two Floridan Don Quixotes lack the imagination to discern that line.

"Impossible" is a word which should be expunged from the lexicon of progressive thought. We may say that certain eventualities appear, to our very limited intelligence, to be impossible. But to go beyond that is both illogical and vainglorious. The human mind, in its present state of development, is incapable of discerning primary verities. The birth and growth of our infant sciences have proved this again and again. Millions of human beings through thousands of years, witnessed the daily revolution of Sun and stars about a stationary Earth. Nothing could have appeared to them more impossible and absurd than to deny this self-evident fact. Yet Copernicus denied it; and for nearly 400 years we have accepted and reiterated his denial. The Ptolemaic theory of the universe, which appears ludicrous to us, survived the tests of scientific research for centuries longer than has any other astronomical hypothesis. One of the first and greatest of the ancient philosophers declared that the noblest achievement of human intelligence is to know that we know nothing. And his reasoning still prevails. Centuries later a most profound logician evoked a masterly sequence of deductions in an endeavor to prove that we do know something. His fundamental proposition, upon which rests the entire structure, has become almost an axiom: "I think; therefore I am." But how about this premise? Do I think? Do I know that thought originates in my mind? Do I know that I have a mind? May I not be merely an insensate medium through which a living stream of thought passes and momentarily illuminates with the glory of its passing?

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beams twinkle with cosmic mirth as, probing speculatively within the solar atom, they find the submicroscopic vermin infesting an obscure electron quarreling acrimoniously among themselves as each proclaims his fatuous laws for governing the conduct of giant suns in farflung galaxies.

"Vive la bagatelle!"—A. S. McEckron, P. O. Box 217, Galva, Kansas.

Velocity of light is not absolute—but it is constant.

Dear Sir:

In answer to Mr. Renner's contention about light in the March issue, I should like to give my opinion.

I believe a perusal of the texts written by any of the better known physicists would reveal the fact that the speed of light is absolute—in fact, according to Einstein, it is the only absolute thing in the universe. All other motion is relative. This is generally accepted by physicists. Therefore, light could not possibly have a speed greater than its measured velocity—186,000 miles per second, approximately. (However, it can have a lower speed when retarded by a medium such as the atmosphere.)

The change in frequency of light takes place independently of its velocity—velocity and frequency are two different things. As evidence of this, we know that all electromagnetic radiation has the same velocity in space.

Mr. Renner said, "Such light must have the speed of the object which emits it added to its own speed." But we do not know the speed of the object—except relative to the Earth or some other body. On the other hand, we do know the speed of light—and it is an absolute speed.—William M. Wooding, 268 Piedmont St., Waterbury, Conn.

The mass-increase effect multiplies the rest-mass of the thing considered. The mass at light-speed is multiplied by infinity—hence normally equals infinity. But light cannot be at rest, hence has zero rest-mass. Zero times infinity is indeterminate—may be anything.

Dear Mr. Campbell:

Isaac Asimov's letter in the December issue was very interesting, but in his problem he overlooked another of Einstein's statements—one which throws a new light on the problem.

Asimov states that, according to Einstein's law of mass-increase in proportion to speed, the mass of a beam of light should be infinite. If the mass were infinite, the inertia would be infinite also. Therefore, no conceivable force could stop the beam of light. Yet a piece of tissue paper can stop a beam of light. He then asks for an explanation of this paradox.

What Isaac has overlooked is Einstein's statement that space is warped by the presence of mass. This statement disproves Einstein's law that a body traveling at the speed of light would have infinite mass. Or perhaps, vice versa. For if both statements were true, there would be no such thing as radiation. As soon as a body emitted a photon, this photon, having mass and traveling at the speed of light, would attain infinite mass immediately. This mass would warp space completely around itself and would vanish from our space-time into one of its own.

Now, radiation does nothing of the kind. Therefore, one of the two statements is false. The question is, which one?

As for the light and the moving object controversy, I say there would be no light (that is, light visible to the naked eye). Due to the Doppler-Feizeau effect, the light emitted from an object moving at the speed of light would be shifted clear out of the visible spectrum.—George R. Hilt, 1002 S. 21st, Lafayette, Indiana.

BRASS TACKS

Do readers want an occasional fantasy like "Wings of the Storm"?

Dear Mr. Campbell:

All right! Hold on to your hat! Here comes my monthly windy comment on the March issue!

As I tripped lightly down the street my mind hummed a merry tune. "Cause why?" "Cause it was the third Wednesday!" The newsstand loomed on the horizon, and, upon reaching it, I came to a full stop and rubbed my eyes; what was that I saw—Astounding SCIENCE-FICTION? Something wrong there. It didn't sound right. But, upon diving on the copy, I found it was true! Astounding Science-Fiction! The new title is nice, but I feel as though an old friend has died. However, as long as the rest is the same, I have no grievance.

Well, let's see; the logical thing to do is to start with the cover—Owl is all I can say. Please, Editor, keep Wesso off the covers. His first couple weren't so bad, and this one *ditto* seem a little better after I had read the story, but still, we want more Brown. Also, we want more figures in the covers. Something like the ones for "The Incredible Invasion" and for "I Am Not God."

I think I'll deviate from the usual routine now and discuss the interior illustrations next. My next statement will probably shock a lot of people, but here goes: Let's have less Wesso and more Dold! I'll admit that Wesso's good, but I think there are a lot of people who prefer Dold, Schneeman, and Blunder. But don't, of course, eliminate Wesso; just cut him down a bit.

Maybe it's just because I was in a scientific frame of mind, but I really enjoyed "Something from Jupiter" immensely. Or maybe it was because, for once, we had a story in which interplanetary travel wasn't just an everyday occurrence. Anyway, it was out of the usual run, and I enjoyed it.

"Flight of the Dawn Star" had rather a shall we say—rehashed plot, but it was written in such a beautiful and wistful manner that I was held in a spell until the very last word.

Oh, readers, *how* can you toss brickbats when there's nothing to toss them at? What I just said about the "rehashed plot" has no more conviction behind it than a scientist has in saying that the Moon is made out of green cheese. And when I speak about "The Master Shall Not Die," words fail me. I have fondly placed it in my long list of classics which have appeared in Astounding.

Now we come to "A Duel in the Space Lanes". As I said last month, it's nice to get a good old interplanetary story among a host of thought-variants, and this one takes the cake, or—wait a minute—it would take it were it not for Kent Casey's "Flareback". Now there is something! When I first glanced at this story, I saw the caption "—by a new author with a new style—" so I immediately looked, and my eye fell upon "and make sure no big, bad, Uranians bite him after he's through chewing the fat. Wotta life! Wotta life!" Oh-oh, I said, this is going to be awful! A minute later I was rolling with laughter at the witticisms of Dr. Von Thiel and his companion-in-arms. More by this author, by all means.

I won't comment upon "Jason Sows Again" until it concludes next month—this so I won't go off on the wrong steer.

Now Mr. Campbell! How could you publish a monstrosity like "Wings of the Storm"? We do not want weird tales in Astounding. It was so unreal and absurd that I weep just to think of it!

"Martyrs Don't Mind Dying" had its good points, but the plot was positively mouldy.

It's not my custom to criticize articles, but I found the series by Willey (or is it Willy?) Ley so interesting that I had to put in a word of praise.

Van Lorne scores again! "Vibratory" was, in mine 'umble opinion, a masterpiece, although greatly (and when I say that I mean it) in



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need of a sequel. So come on, Warner, don't keep us in suspense!

"Eye of the Past" was nothing to cheer about, but it has a warm place in my heart; the idea of the atom-searcher was breath-taking, to say the least. But we never found the identity of the destructive invaders. I don't believe that any intelligent force would deliberately destroy a civilization without at least attempting to communicate with them.

For a general improvement on the make-up of the magazine, I would suggest moving "In Times to Come" to a more prominent place, say on the other side of the Editor's Page. Also more interplanetary novelettes, editor's comments at the end of each letter—and here's an idea for a new feature—how about a column entitled "In Times Past" in which we can mentally look back on the old stories of three or four years ago, and recall our emotions when we first read this or that story.

Thanks, Ed, for removing the advertisements from around Brass Tacks! However, keep the Reader's Department in the back!—Henry Boernstein, 1071 Mount Royal Blvd., Outremont, Montreal, Canada.

I'd like information on that convention.

Dear Mr. Campbell:

In my opinion the cover on the March 1938 issue of Astounding Science-Fiction is the best cover since June 1936 which illustrated "The Shadow Out of Time."

Binder only had three pictures in this last issue. I would like to see him illustrate the entire magazine.

All of the stories were good this time. "Vibratory" was best and "Martyrs Don't Mind Dying" was next best.

"Flight of the Dawn Star" has an old plot in a way, but it is worked out well. It is reminiscent of Don A. Stuart's style. Speaking of Stuart, I think that the man is either part genius or he's crazy. I don't like his stories. They are too deep for me. I read all of his work, and once in a while I catch a glimmering of light but most of the time I am in the dark (concerning his stories). But what I see when I catch that glimmer makes me want more.

Have you heard anything of a Scientifiction Convention to be held in New York in 1940? I read a small article which stated that there would be a convention there at that time but the article didn't give any details.

Well, here's wishing you luck and may Astounding continue to improve each month as much as it has been improving—Willard Dewey, 1005 Charles St., Everett, Wash.

Astronomers?

Dear Editor:

I am very desirous of forming a club of astronomy enthusiasts. Anyone who is interested should get in touch with me at once!—Abraham Oshinsky, 117 Van Buren Street, Brooklyn, N. Y.

Pro—

Dear Mr. Campbell:

You've no doubt forgotten me, but I haven't forgotten you by any means, even though I have neglected to write for the past three (isn't that horrible?) issues, due to various reasons—mostly financial. At last, I've been able to get the last three issues of the magazine from January to March, and have just returned from the hospital, where the shock of what I'd seen sent me.

The last I'd seen of Astounding Stories was a magazine that wasn't worthy to be called an apostle of that great (?) force called science-fiction! It was better suited for the junk pile. The next three issues were the most remarkable improvement that we have ever seen in any science-fiction magazine. There can't be any denying it. It is excusable when the stories that are submitted are all poor, for then the poor editor can't do anything about it. We've seen in three short issues stories improved thousands of per cent. No sudden spurt of genius on the part of the authors can account for such a change. Therefore, it must be

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the editor. Thusly, I now pronounce John W. Campbell, Jr., as a genius of the first degree. His name ranking second only to that of Hugo Gernsback in the science-fiction roster.

Now, I can get on to the magazine itself. The greatest change was the new name for the publication. For years we have been waiting for the name "science-fiction" to appear on the title of a magazine, and, except for a brief time on the first six 1933 Amazing Stories, we have never had this greatest wish of all granted. However, something seems to be missing in the lack of the word "stories" on the title, but the addition of one totally overshadows the deletion of another.

I agree with the two readers who remarked on the utter uselessness of "Galactic Patrol." Even from Schachner it would have been a bad story, but from the great E. E. Smith, Ph. D.—why, that is the greatest shock one can imagine. The continuity was too scattered, the science—or what science I could find—was all off, and it certainly looks puny compared to even an average story by an average author. Amen.

Just consider; the March issue had more good stories than there were in the whole of 1937, and in the last three issues there have been more good stories than in both 1937 and 1936, though 1936 was not without its epics.

"Something From Jupiter" was better than the best story in 1937 and was ultra-plus-ultra. "Flight of the Dawn Star" was just fair, according to the new basis of judgment which it has been necessary to formulate, but according to the old standard it would have been an epic.

And now "Jason Sows Again." It is a peculiar mixture of genius and not-so-hot. The plot is ordinary enough, nothing greatly different, though the weapon is. It starts out like a masterpiece. Wunderbar! Tres Bon! Exelente! Emenfe! Or any other word meaning very good. Along about the middle it tames down to an ordinary style of writing, though it is still good. But, the science in the story is a little off somewhere. No matter how fantastic a theory is, if it sounds convincing, it is passable. If it doesn't sound convincing, it shouldn't be in the story. The science isn't convincing, and therefore it takes a great deal away from the story. Still, it was very good, and I hope that the second chapter is half as good as the first.

"Duel in the Space Lanes" was a very fine adventure story, well written and all the rest.

"Wings of the Storm" was—well, what do you think? It was the only story in the issue that was reminiscent of the other regime. In other words—not so hot. Do you think that it's possible? Neither do I, nor lots of other fans. As I've said, if the science in a story isn't convincing, the story is always detracted from.

"Martyrs Don't Mind Dying" was about the best time-story ever, but in the end it gets into the inevitable hopeless mixup which all such stories are bound to come to. Trying to not do something in the past that wasn't done, yet it was done, or he wouldn't be trying not to do it again. Aghhhhhh—What do you think of it?

"Power Plants of Tomorrow" is about the best article you've run. It should be called "Power Plants That Could Be Used Today." This particular installment was the best in this particular series, also.

"Vibratory" was the best short in the issue, I guess, and was very good, though, as is the usual case, the plot has been used over and over in one form or another.

"Flareback" comes next, but was not vastly different from the usual new-invention-during-space-war type of story. But it was well written.

Last was "Eyes of the Past." This was only fairly good scientifically, somewhat worn out in plot, but was so well written that it makes up for itself. My vote for the best in the issue goes to "Something From Jupiter."

And that finishes this missile. Congratulations, Editor Campbell, you've given all of the fans, in three months, what they've been yelling for for years. All I can think of now is for you to put a blurb on the contents page, or somewhere, telling us about the cover. I now place Astounding Science-Fiction at the head of the list.

Best of luck.—T. Bruce Yerke, 1256, N. Kingsly Dr., Hollywood, Calif.

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Dear Mr. Campbell:

After reading your various editorials I often wonder if you think that your readers are contented and pleased with your work as editor of Astounding. Apparently you seem to think they are. Perhaps you are right in thinking so, but I'll never acknowledge the fact until you have taken a "right-about face" and change your present views and policies.

In the few short months that you have been editor, you have destroyed practically all of the marvelous work that Tremaine had done for several years before you. You have broken up and disfigured every point that he strove to uphold. The magazine has now absolutely no tradition to look up to. From the first of your issues, the magazine has had a rushed, slapped-together air about it. Even the printers seem to sense it. My last few issues have been loosely bound, raggedly cut, covers set up unevenly—all in all a general slovenly appearance.

Truthfully, I can say the mag is not one quarter as good as in 1934, and not a fifth as good as in 1937—certainly not very complimentary to you. Its stories have declined in quality—each issue is just a bit poorer than the preceding. Its art work has gone down frightfully. Brass Tacks has been neglected, heavy science articles have increased. All these signs point to a slow but sure break-down of the old policy. Worst of all—or perhaps it seems the worst to me—is the disgracing placement of Brass Tacks. In the March issue its position was excellent. Why couldn't it have been left there, instead of being shoved among columns of advertising? Science Discussions is good and should be kept, but in moderation. Why is it to-day we rarely see any more of the highly enjoyable letters of the type once printed in the old Wonder Stories? That was a department to be proud of!

Concerning the science articles: they are all right in their place—but their place isn't exactly in science-fiction. When a reader finds one of these interesting, and they usually are, I know that he would just as soon read the same article in a scientific magazine, thus conserving Astounding's space. Many a fine novel or extension of Brass Tacks could be very well put on these pages.

As I have started out by being critical of your régime, Mr. Campbell, I might as well continue along in that vein. There are plenty of things to find fault with, never fear. For instance, I mentioned above that your art work has declined steadily for the past few months. Only Dold, it seems, has stayed up to his usual high standard. Wesso is scarcely worth mentioning among the top-flight artists, now. Binder is excellent at times, but all too often, poor. Schneeman is improving with the years, I might add. But why have you suddenly used unbound illustrations? Pictures without border give the mag a much more undignified and cheap appearance.

Finally, in your editorial of April, 1938, you ended by emphatically saying that Astounding was not a dictatorship. I very much doubt that statement. Who asked to have the title changed? Who asked for "mutants"? Who asked for the letters to be surrounded by ads? Who asked for this all-around metamorphosis, such as the new publication date, new-concept stories and the like? Certainly not the mass of your readers, and I doubt very much if the few influential science-fiction fans wanted such abrupt and unsatisfactory changes, either. Therefore, it must be either the publishers or yourself, whom I will take the liberty of calling "Dictator" Campbell until such time as you have changed sufficiently to warrant another title. Remember, you brought this on yourself. Yours for a less "mutant-ed" Astounding.—James S. Avery, 55 Middle St., Skowhegan, Maine.

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Science club members—attention!

Dear Editor:
 Congratulations on your fine set-up of recent months and your mutant ideas. The astronomical cover plate was tops, as was "Anachronistic Optics" by M. Schere. Keep your eye on him, for he has a remarkable story-telling ability

rarely found in science-fiction. He's a top-notch on handling human emotions, and should go places. Would you please announce the following: Will all science-fiction fans who are graduates of New York City high schools, and who belonged to their high-school science clubs, communicate with the Secretary of Kappa Phi Kappa at 206 Seventh Avenue, Brooklyn, New York. A city-wide organization of scientific high school alumni is being formed, with the cooperation of the American Institute.—Warren J. Woolsey, President.

Ain't Nature grand!—at times!

My dear Mr. Campbell:

I am writing this by the flickering flame of my wee tallow dip, here in the middle of flood-bound Los Angeles. What with all our modern devices of science getting it in the neck from outraged Nature, it is a very good thing we have not forgotten the simpler methods of our ancestors—this candle, for instance, as well as the good old safety razor with lots of soap lather, in place of the latest electrically scientific business for removing whiskers from the face. Science is wonderful—when it works!

Anyhow, this is not a news letter. I've got something to say, and I really had best be about it. Brass Tacks gives one a better chance to air his views than did Science Discussions. Science Discussions was really very lovely, and all that sort of thing—I even had a letter printed therein about a year ago, from which I received results in the way of two concerns wanting to sell me back numbers of magazines. I received the final letter just the other day, and it came all the way from England. It's a small world, and not at all strange how one's name gets bruited about even to the antipodes.

That time, too, I aired a few opinions on the progress of our magazine. And this time I am just going to air—opinions. I've been reading science-fiction since its inception in 1925 or thereabouts, and, as time has progressed, I have followed always the better stream. Many brooklets have diverged from the original course, and it is my opinion that Astounding has imitators—not competitors—unworthy the name of science-fiction, being not even a reasonably accurate facsimile of same. But even the step of the boldest and the best falters at times. I speak in particular of a few stories during the past year which struck me as being not quite *comme il faut*.

"Ormely of Roonerion" for instance. That one was permissible to be inserted in the Third Reader as a diversion from tales of Br'er Rabbit, Reynard the Fox, etc., *ad nauseam*. I never felt so written down to in my life—and I've read a lot in several different languages. Not a polysyllable, not a compound—not to speak of complex—sentence! I can't think of any others off-hand that erred so greatly in this respect. (I won't mention the moth-eaten Cinderella plot, simply inane incidents, nor the stereotyped characters.) It seems to me also that blight is creeping in here and there, as witness "A Duel in the Space Lanes". Weak in motive, shallow in its conception. However, all stories can't be good, so I'm not kicking—much.

For my part, I found that "Galactic Patrol" lived up to its ballyhoo in the first and second installments, and after that it wasn't so good as it had bade fair to be. Too slow for one thing. The final installment was the hat placed on crooked, so to speak. Baskone is revealed—or remains unrevealed?—as nothing whatever, with no reason for existence—no answer to the question, why? We followed that story for six months, waiting for the author to answer the questions he had brought up. Did he? Perhaps—but neither completely nor satisfactorily.

The best issue to date—since this time last year—is the current issue, March. Not counting "Jason Sows Again"—which I won't read until next month when I get part two—I can count six little gems and only three duds.

"The Master Shall Not Die" was the best in the book.

"Something From Jupiter" was excellent, as also "Flight of the Dawn Star", "Wings of the Storm", "Vibrator", and "Flareback" belong also in this same category.

The weakest yarn was "Duel in the Space

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Lanes"—already commented on. "Martyrs Don't Mind Dying" contained a bit too much blood and thunder—penny dreadful, I might say, with not quite strong enough characterization, and a conclusion that did not merit the build-up. "Eye of the Past" I have placed among the duds, although it did not plop as heavily as the other two. My main objection is that the Binder brothers have been harping upon the same chord about long enough. Let's permit ourselves to avoid warfare past, present, and future. E and O had the makings there of a fine little yarn without dragging in an unknown and unexplained, as well as unmotivated, conflict between the Tellurians and Heaven knows what. I know they've enough imagination to dope out something the earth-people could have fought—so why didn't they? At least intelligent worms, caterpillars, ants, roaches, beetles, or toadstools. Or maybe the boys are slipping? I'm still waiting for something as good as they used to write to show up.

If you, Mr. Campbell, get to see this letter, you probably won't be very enthusiastic to learn that I am sending you a story under separate cover which you probably won't see, anyway, as it is every bit as lousy as some published stories.

I am sorry if I have seemed to ride roughshod over cherished points; however, see how few I have picked from the past twelve months! All in all, Astounding is making a very good place for itself among the fiction of the day—and I haven't ceased to buy yet!

You have my assurance of continued support of your fine magazine.—Manly M. Banister, 920 West Ninth St., Los Angeles, California.

He waits till he's got a winner before he writes.

Dear Editor:

The first part of "Three Thousand Years!" was too short, but it is right up the old Thomas Calvert McClary alley and looks like another winner.

Either he's smart and only writes, (or would it be signs?) winners, or else he's wasting his talents by not writing oftener. For one, I'd like to see him at least every other month or so. He writes about such original situations that there is little danger of getting tired of him.—Richard Bischoff, 2121 New York Avenue N. W., Apt. 805, Washington, D. C.

"Jason" a nightmare.

Dear Editor:

Just a few lines thumped out on ye olde typewriter to let you and yours know how much I appreciated the April masterpiece of Astounding Science-Fiction.

To me, a mere avid reader of interesting fiction of all sorts, plus a bit of scientific knowledge practically insignificant in its amount, your magazine is tops in its field, and its field is tops to all others, if you get what I mean.

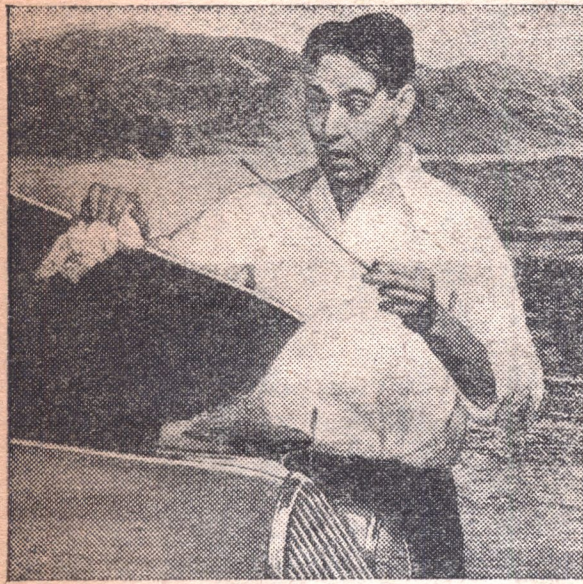
This past issue was O. K. except for that misfit of a child's nightmare known as "Jason Sows Again". I never did care much for Burks anyhow. I've read him in other magazines and he doesn't agree with my metabolism.

I liked the idea of not so many ultra-shorts and stories a little longer. The stories themselves were good with "Hyperpelosity" tops in the short stories, and "Negative Space" and "Iszt—Earthman" running even and both very good—in fact, better than usual. (I.e. track like "Mercurian Adventure" and that super-super-super science story, "Galactic Patrol"). "Three Thousand Years!" has all the beginnings of a good novel and if it keeps up like it started I'll be satisfied.

And of your artists, Dold seems to me to put over the best ideas. Who was it that drew (?) that nightmarish concoction illustrating "Matter Is Conserved"?

Here's hoping my first letter reaches the place of the elect in Brass Tacks.—Frederick G. Kempin, Jr., 623 W. Diamond St., Philadelphia, Pa.

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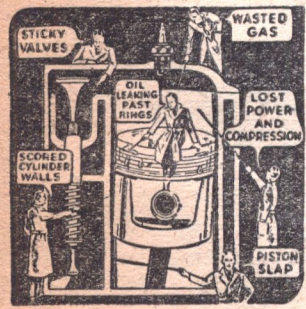
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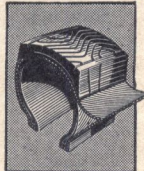
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"Cigarettes seem alike to me. Do you find some difference between Camels and the others, Miss Bourke-White?"

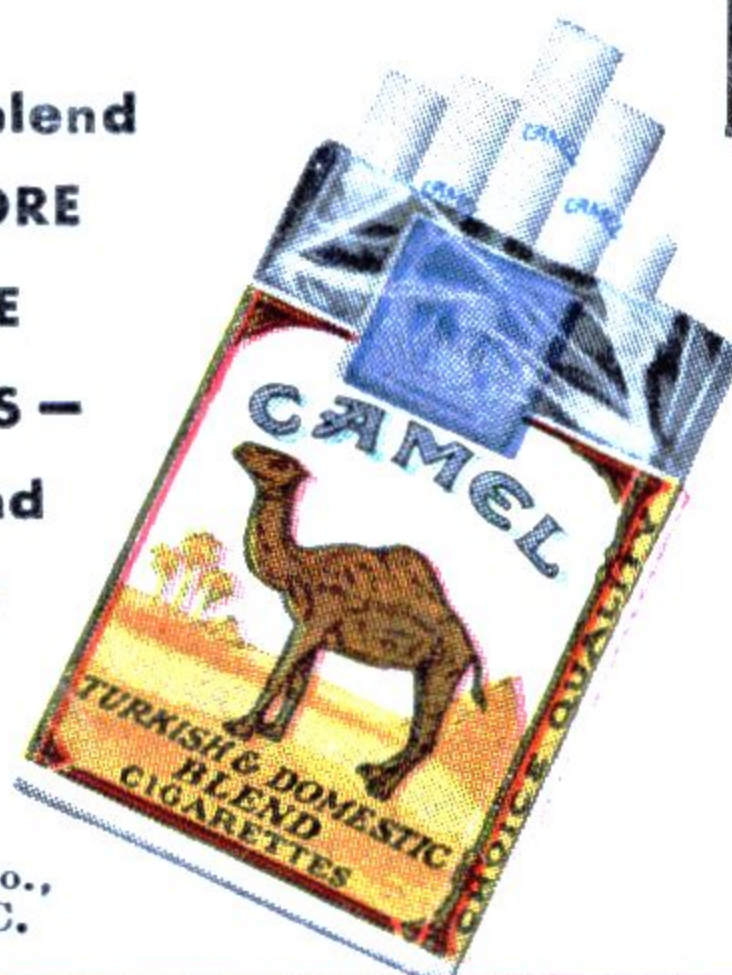


LUMBER CAMPS, dams, mines, subways (as above)— appeal to Margaret Bourke-White. She has gone all over the United States, to the Arctic, to far countries. Her photographs are famous. They're *different!* And that's just what Miss Bourke-White said about Camels at the New York World's Fair grounds (right).

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