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By ISAAC ASIMOV

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SCIENCE-FICTION

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OPTICAL INSTRUMENTS

THERE seems to be nothing like a hobby of photography to engender in one a proper respect for the abilities of the human eye as an optical instrument. Any lens grinder or optical technician can tell you that the human eye is a horribly designed camera, subject to all the forms of optical aberration known to optical science, plus several original types.

The major forms of lens trouble are spherical aberration, chromatic aberration and astigmatism. The eye has 'em all. In camera lenses to overcome spherical aberration exceedingly complex calculations requiring months of research and exceedingly exact shaping of the surface are required. Usually, really good camera lenses consist of four to seven separate lens elements, individual lenses one behind another, accurately spaced one from the other. Chromatic aberration—separation of red, yellow and blue images due to the different refraction of the light of different frequency—is overcome by balancing different kinds of glass, having different properties, so that the effect is overcome in the course of the multiple lens elements. Astigmatism is overcome in the camera lens by very accurate shaping of the surfaces.

A camera lens, if wiped with a handkerchief which has a bit of sand on it, is quickly ruined. If struck any kind of a sharp blow, it breaks, of course. It is focused by racking it in and out.

The eye has a two-part lens; the cornea being as much part of the lens system as the "lens" itself. The "lens" is simply an adjustable focusing supplement. It suffers from chromatic aberration—and makes up for it in the retina, by having the various color-sensitive optic nerves at different depths, each located at a depth where light of the appropriate color comes to focus. Spherical aberration is partly compensated for by using a curved "film holder" instead of a flat one, as do most cameras. (Cheap box cameras using simple lenses get around the same defect in the same way—they have curved backs. Still simpler cameras have flat backs, and ignore the defect.) The brain has the ability to take care of the rest of the distortion. In addition, the eye has its area of really high definition in the center, directly back of the lens, where the effect of aberration is minimal. Neat and effective.

Furthermore, the eye can stand a terrific beating. It has a built-in lens cleaner that will not ruin the lens, no matter how dusty and gritty the atmosphere. Hit by a fist, it bounces instead of breaking. The eye is fragile only in comparison to the still more astonishing durability of the rest of the human frame.

The human eye is designed for a field of vision that is comparatively narrow, as animal eyes go. (Each of a rabbit's eyes covers more than a hemisphere; that's why the beastie has such pop eyes. Very useful to him; he can see the end of his tail and the lettuce leaf he's gnawing at the same

time—and also any enemies anywhere in any direction.) But the human eye covers a lot more angle than any ordinary camera.

Film is as much part of a camera as the lens—neither's useful without the other. And while the lens maker can still make some arguments in favor of his glass lenses—they have high definition over the whole field of view, while the eye has high resolving power only in a narrow angle—the film maker is hopelessly outclassed.

There are two broad classes of film—black and white, and color film. The eye has two types, too—you get black-and-white vision when the light's very dim. Moonlight scenes, for instance, are actually colorless, whatever you may believe. Any color you see is supplied by memory. But the eye *can* take high-speed movies by moonlight—and it doesn't need full-moon light, either. Using much bigger lenses, and the fastest, most sensitive films produced, no camera can take snapshots by moonlight. Worse by far, in an ordinary room lighted by one ordinary shaded light, the eye sees full detail and full color at snapshot speed. The fastest black-and-white film, using far bigger lenses, can't even get a faint image. And color film, under such conditions, requires exposures measured in minutes.

Another little trick the eye has; in a room illuminated by one lamp, there will be a spot of strong light, and rapidly fading intensity in the rest of the room, more or less following the inverse-square law. The eye sees every detail in the entire room. No camera exposure, no matter how adjusted or how long, can record full details both near the light and in far corners.

The camera can't use more than one type of film at once; the eye uses whatever number of different types it needs at any one moment. That part of the eye recording the bright spot under the lamp is using a fairly low-sensitivity, full-color photochemistry. The part reproducing the dimmest corners, on the other hand, has switched over to a supersensitive black-and-white chemistry, and is blending in stored color schemes from the memory department. Sort of a hand-tinted black-and-white, instead of a natural-color photograph. But it does it in a tenth of a second, which no camera could do, even with a patchwork film.

No camera maker would ever accept an optical instrument as sloppily designed as the eye—but there are a lot of features about it any camera maker would love to be able to get. It is, in effect, the camera maker's ideal: a superfast miniature camera so sharp in focus as to resolve newsprint at a distance of as much as ten feet, taking full-color snapshots under perfectly impossible conditions, and capable of black-and-white snapshots with usable detail on a moonless, starlit night.

A bird's eyes, incidentally, seem to beat even that record. They have full-color vision, and vultures, et cetera, clearly indicate a perfectly terrific ability to see details. They are, further, far smaller than even the smallest movie camera ever attempted. And—they can see sharply at any distance from about one inch to infinity *without any focusing arrangement whatever*,

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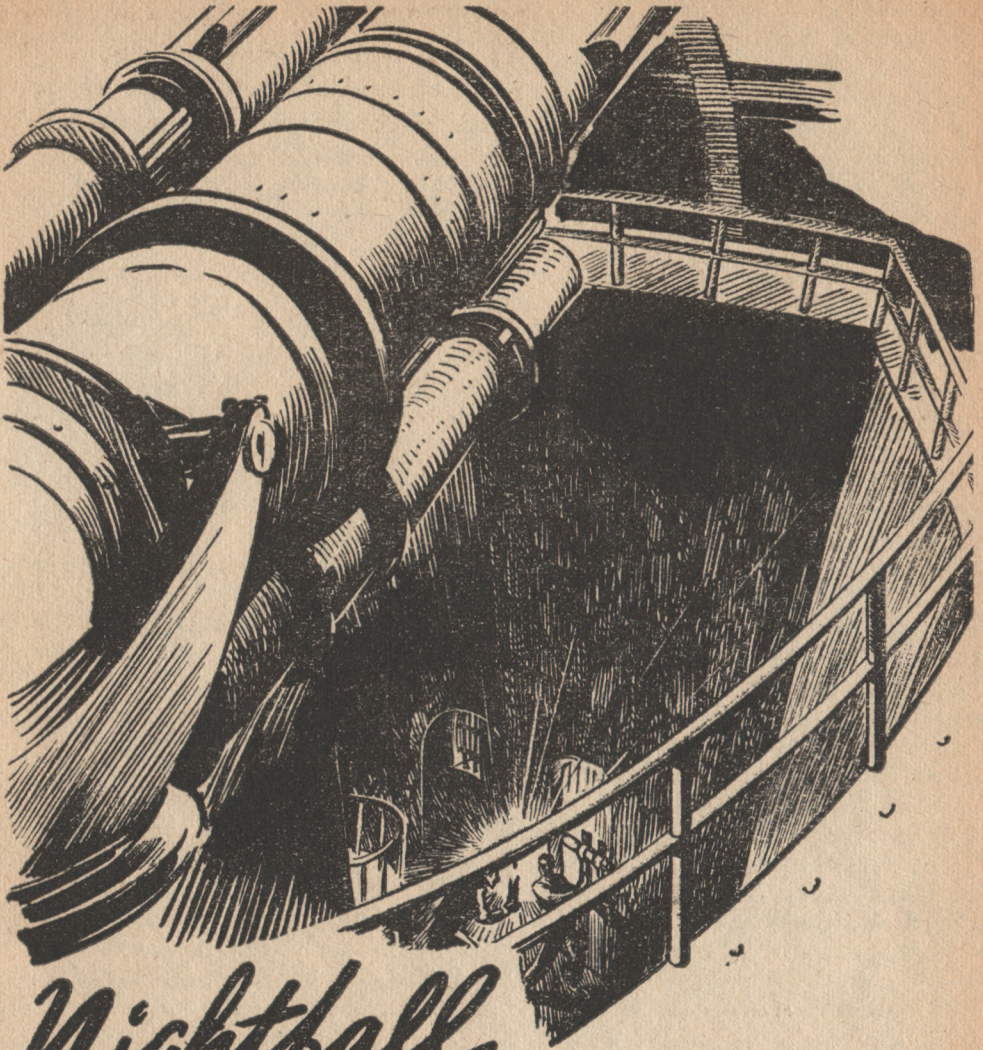
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Street & Smith's

NATIONAL
MAGAZINE

September Issue



Nightfall

By Isaac Asimov

How would a people who saw the stars but once in two thousand years react—

Illustrated by Kolliker

"If the stars should appear one night in a thousand years, how would men believe and adore, and preserve for many generations the remembrance of the city of God!—Emerson

ATON 77, director of Saro University, thrust out a belligerent lower lip and glared at the young newspa-

perman in a hot fury.

Theremon 762 took that fury in his stride. In his earlier days, when his now widely syndicated column was only a mad idea in a cub reporter's mind, he had specialized in "impossible" interviews. It had cost him bruises, black eyes, and broken bones; but it had given him an ample supply of coolness and self-confidence.

So he lowered the outthrust hand that had been so pointedly ignored and calmly waited for the aged director to get over the worst. Astronomers were queer ducks, anyway, and if Aton's actions of the last two months meant anything, this same Aton was the queer-duckiest of the lot.

Aton 77 found his voice, and though it trembled with restrained emotion, the careful, somewhat pedantic, phraseology, for which the famous astronomer was noted, did not abandon him.

"Sir," he said, "you display an infernal gall in coming to me with that impudent proposition of yours."

The husky telephotographer of the Observatory, Beenay 25, thrust a tongue's tip across dry lips and interposed nervously, "Now, sir, after all—"

The director turned to him and lifted a white eyebrow. "Do not interfere, Beenay. I will credit you with good intentions in bringing this man here; but I will tolerate no insubordination now."

Theremon decided it was time to take a part. "Director Aton, if you'll let me finish what I started saying I think—"

"I don't believe, young man," retorted Aton, "that anything you could say now would count much as compared with your daily columns of these last two months. You have led a vast newspaper campaign

against the efforts of myself and my colleagues to organize the world against the menace which it is now too late to avert. You have done your best with your highly personal attacks to make the staff of this Observatory objects of ridicule."

The director lifted the copy of the *Saro City Chronicle* on the table and shook it at Theremon furiously. "Even a person of your well-known impudence should have hesitated before coming to me with a request that he be allowed to cover today's events for his paper. Of all newsmen, you!"

Aton dashed the newspaper to the floor, strode to the window and clasped his arms behind his back.

"You may leave," he snapped over his shoulder. He stared moodily out at the skyline where Gamma, the brightest of the planet's six suns, was setting. It had already faded and yellowed into the horizon mists, and Aton knew he would never see it again as a sane man.

He whirled. "No, wait, come here!" He gestured peremptorily. "I'll give you your story."

The newsman had made no motion to leave, and now he approached the old man slowly. Aton gestured outward, "Of the six suns, only Beta is left in the sky. Do you see it?"

The question was rather unnecessary. Beta was almost at zenith; its ruddy light flooding the landscape to an unusual orange as the brilliant rays of setting Gamma died. Beta was at aphelion. It was small; smaller than Theremon had ever seen it before, and for the moment it was undisputed ruler of Lagash's sky.

Lagash's own sun, Alpha, the one about which it revolved, was at the antipodes; as were the two distant companion pairs. The red dwarf Beta—Alpha's immediate compan-

ion—was alone, grimly alone.

Aton's upturned face flushed redly in the sunlight. "In just under four hours," he said, "civilization, as we know it, comes to an end. It will do so because, as you see, Beta is the only sun in the sky." He smiled grimly. "Print that! There'll be no one to read it."

"But if it turns out that four hours pass—and another four—and nothing happens?" asked Theremon softly.

"Don't let that worry you. Enough will happen."

"Granted! And *still*—if nothing happens?"

For a second time, Beenay 25 spoke, "Sir, I think you ought to listen to him."

Theremon said, "Put it to a vote, Director Aton."

There was a stir among the remaining five members of the Observatory staff, who till now had maintained an attitude of wary neutrality.

"That," stated Aton flatly, "is not necessary." He drew out his pocket watch. "Since your good friend, Beenay, insists so urgently, I will give you five minutes. Talk away."

"Good! Now, just what difference would it make if you allowed me to take down an eyewitness account of what's to come? If your prediction comes true, my presence won't hurt; for in that case my column would never be written. On the other hand, if nothing comes of it, you will just have to expect ridicule or worse. It would be wise to leave that ridicule to friendly hands."

Aton snorted. "Do you mean yours when you speak of friendly hands?"

"Certainly!" Theremon sat down and crossed his legs. "My columns may have been a little rough at

times, but I gave you people the benefit of the doubt every time. After all, this is not the century to preach 'the end of the world is at hand' to Lagash. You have to understand that people don't believe the 'Book of Revelations' any more, and it annoys them to have scientists turn about face and tell us the Cultists are right after all—"

"No such thing, young man," interrupted Aton. "While a great deal of our data has been supplied us by the Cult, our results contain none of the Cult's mysticism. Facts are facts, and the Cult's so-called 'mythology' has certain facts behind it. We've exposed them and ripped away their mystery. I assure you that the Cult hates us now worse than you do."

"I don't hate you. I'm just trying to tell you that the public is in an ugly humor. They're angry."

Aton twisted his mouth in derision. "Let them be angry."

"Yes, but what about tomorrow?"

"There'll be no tomorrow!"

"But if there is. Say that there is—just to see what happens. That anger might take shape into something serious. After all, you know, business has taken a nose dive these last two months. Investors don't really believe the world is coming to an end, but just the same they're being cagy with their money until it's all over. Johnny Public doesn't believe you, either, but the new spring furniture might as well wait a few months—just to make sure.

"You see the point. Just as soon as this is all over, the business interests will be after your hide. They'll say that if crackpots—begging your pardon—can upset the country's prosperity any time they want simply by making some cockeyed prediction—it's up to the planet to prevent them. The sparks will fly, sir."

The director regarded the columnist sternly. "And just what were you proposing to do to help the situation?"

"Well," grinned Theremon, "I was proposing to take charge of the publicity. I can handle things so that only the ridiculous side will show. It would be hard to stand, I admit, because I'd have to make you all out to be a bunch of gibbering idiots, but if I can get people laughing at you, they might forget to be angry. In return for that, all my publisher asks is an exclusive story."

Beenay nodded and burst out, "Sir, the rest of us think he's right. These last two months we've considered everything but the million-to-one chance that there is an error somewhere in our theory or in our calculations. We ought to take care of that, too."

There was a murmur of agreement from the men grouped about the table, and Aton's expression became that of one who found his mouth full of something bitter and couldn't get rid of it.

"You may stay if you wish, then. You will kindly refrain, however, from hampering us in our duties in any way. You will also remember that I am in charge of all activities here, and in spite of your opinions as expressed in your columns, I will expect full co-operation and full respect—"

His hands were behind his back, and his wrinkled face thrust forward determinedly as he spoke. He might have continued indefinitely but for the intrusion of a new voice.

"HELLO, hello, hello!" It came in a high tenor, and the plump cheeks of the newcomer expanded in a pleased smile. "What's this morgue-like atmosphere about here? No one's losing his nerve, I hope."

Aton started in consternation and said peevishly, "Now what the devil are you doing here, Sheerin? I thought you were going to stay behind in the Hideout."

Sheerin laughed and dropped his tubby figure into a chair. "Hideout be blowed! The place bored me. I wanted to be here, where things are getting hot. Don't you suppose I have my share of curiosity? I want to see these Stars the Cultists are forever speaking about." He rubbed his hands and added in a soberer tone, "It's freezing outside. The wind's enough to hang icicles on your nose. Beta doesn't seem to give any heat at all, at the distance it is."

The white-haired director ground his teeth in sudden exasperation, "Why do you go out of your way to do crazy things, Sheerin? What kind of good are you around here?"

"What kind of good am I around there?" Sheerin spread his palms in comical resignation. "A psychologist isn't worth his salt in the Hideout. They need men of action and strong, healthy women that can breed children. Me? I'm a hundred pounds too heavy for a man of action, and I wouldn't be a success at breeding children. So why bother then with an extra mouth to feed? I feel better over here."

Theremon spoke briskly, "Just what is the Hideout, sir?"

Sheerin seemed to see the columnist for the first time. He frowned and blew his ample cheeks out, "And just who in Lagash are you, red-head?"

Aton compressed his lips and then muttered sullenly, "That's Theremon 762, the newspaper fellow. I suppose you've heard of him."

The columnist offered his hand. "And, of course, you're Sheerin 501 of Saro University. I've heard of

you." Then he repeated, "What is this Hideout, sir?"

"Well," said Sheerin, "we have managed to convince a few people of the validity of our prophecy of—er—doom, to be spectacular about it, and those few have taken proper measures. They consist mainly of the immediate members of the families of the Observatory staff, certain of the faculty of Saro University and a few outsiders. Altogether, they number about three hundred, but three quarters are women and children."

"I see! They're supposed to hide where the Darkness and the—er—Stars can't get at them, and then hold out when the rest of the world goes poof."

"If they can. It won't be easy. With all of mankind insane; with the great cities going up in flames—environment will not be conducive to survival. But they have food, water, shelter, and weapons—"

"They've got more," said Aton. "They've got all our records, except for what we will collect today. Those records will mean everything to the next cycle, and *that's* what must survive. The rest can go hang."

Thereumon whistled a long, low whistle and sat brooding for several minutes. The men about the table had brought out a multichess board and started a six-member game. Moves were made rapidly and in silence. All eyes bent in furious concentration on the board. Thereumon watched them intently and then rose and approached Aton, who sat apart in whispered conversation with Sheerin.

"Listen," he said, "Let's go somewhere where we won't bother the rest of the fellows. I want to ask some questions."

The aged astronomer frowned sourly at him, but Sheerin chirped

up, "Certainly. It will do me good to talk. It always does. Aton was telling me about your ideas concerning world reaction to a failure of the prediction—and I agree with you. I read your column pretty regularly, by the way, and as a general thing I like your views."

"Please, Sheerin," growled Aton.

"Eh? Oh, all right. We'll go into the next room. It has softer chairs, anyway."

THERE *were* softer chairs in the next room. There were also thick red curtains on the windows and a maroon carpet on the floor. With the bricky light of Beta pouring in, the general effect was one of dried blood.

Thereumon shuddered, "Say, I'd give ten credits for a decent dose of white light for just a second. I wish Gamma or Delta were in the sky."

"What are your questions?" asked Aton. "Please remember that our time is limited. In a little over an hour and a quarter we're going upstairs, and after that there will be no time for talk."

"Well, here it is." Thereumon leaned back and folded his hands on his chest. "You people seem so all-fired serious about this that I'm beginning to believe you. Would you mind explaining what it's all about?"

Aton exploded, "Do you mean to sit there and tell me that you've been bombarding us with ridicule without even finding out what we've been trying to say?"

The columnist grinned sheepishly. "It's not that bad, sir. I've got the general idea. You say that there is going to be a world-wide Darkness in a few hours and that all mankind will go violently insane. What I want now is the science behind it."

"No, you don't. No, you don't," broke in Sheerin. "If you ask Aton

for that—supposing him to be in the mood to answer at all—he'll trot out pages of figures and volumes of graphs. You won't make head or tail of it. Now if you were to ask me, I could give you the layman's standpoint."

"All right; I ask you."

"Then first I'd like a drink." He rubbed his hands and looked at Aton.

"Water?" grunted Aton.

"Don't be silly!"

"Don't you be silly. No alcohol today. It would be too easy to get my men drunk. I can't afford to tempt them."

The psychologist grumbled wordlessly. He turned to Theremon, impaled him with his sharp eyes, and began.

"You realize, of course, that the history of civilization on Lagash displays a cyclic character—but I mean, *cyclic!*"

"I know," replied Theremon cautiously, "that that is the current archaeological theory. Has it been accepted as a fact?"

"Just about. In this last century it's been generally agreed upon. This cyclic character is—or, rather, was—one of *the* great mysteries. We've located series of civilizations, nine of them definitely, and indications of others as well, all of which have reached heights comparable to our own, and all of which, without exception, were destroyed by fire at the very height of their culture.

"And no one could tell why. All centers of culture were thoroughly gutted by fire, with nothing left behind to give a hint as to the cause."

Theremon was following closely. "Wasn't there a Stone Age, too?"

"Probably, but as yet, practically nothing is known of it, except that men of that age were little more than

rather intelligent apes. We can forget about that."

"I see. Go on!"

"There have been explanations of these recurrent catastrophes, all of a more or less fantastic nature. Some say that there are periodic rains of fire; some that Lagash passes through a sun every so often; some even wilder things. But there is one theory, quite different from all of these, that has been handed down over a period of centuries."

"I know. You mean this myth of the 'Stars' that the Cultists have in their 'Book of Revelations.'"

"Exactly," rejoined Sheerin with satisfaction. "The Cultists said that every two thousand and fifty years Lagash entered a huge cave, so that all the suns disappeared, and there came *total darkness all over the world!* And then, they say, things called Stars appeared, which robbed men of their souls and left them unreasoning brutes, so that they destroyed the civilization they themselves had built up. Of course, they mix all this up with a lot of religious-mystic notions, but that's the central idea."

There was a short pause in which Sheerin drew a long breath. "And now we come to the Theory of Universal Gravitation." He pronounced the phrase so that the capital letters sounded—and at that point Aton turned from the window, snorted loudly, and stalked out of the room.

THE TWO stared after him, and Theremon said, "What's wrong?"

"Nothing in particular," replied Sheerin. "Two of the men were due several hours ago and haven't shown up yet. He's terrifically short-handed, of course, because all but the really essential men have gone to the Hideout."

"You don't think the two deserted, do you?"

"Who? Faro and Yimot? Of course not. Still, if they're not back within the hour, things would be a little sticky." He got to his feet suddenly, and his eyes twinkled. "Anyway, as long as Aton is gone—"

Tiptoeing to the nearest window, he squatted, and from the low window box beneath withdrew a bottle of red liquid that gurgled suggestively when he shook it.

"I *thought* Aton didn't know about this," he remarked as he trotted back to the table. "Here! We've only got one glass so, as the guest, you can have it. I'll keep the bottle." And he filled the tiny cup with judicious care.

Thereumon rose to protest, but Sheerin eyed him sternly. "Respect your elders, young man."

The newsman seated himself with a look of pain and anguish on his face. "Go ahead, then, you old villain."

The psychologist's Adam's apple wobbled as the bottle upended, and then, with a satisfied grunt and a smack of the lips, he began again.

"But what do you know about gravitation?"

"Nothing, except that it is a very recent development, not too well established, and that the math is so hard that only twelve men in Lagash are supposed to understand it."

"*Tcha!* Nonsense! Boloney! I can give you all the essential math in a sentence. The Law of Universal Gravitation states that there exists a cohesive force among all bodies of the universe, such that the amount of this force between any two given bodies is proportional to the product of their masses divided by the square of the distance between them."

"Is that all?"

"That's enough! It took four hun-

dred years to develop it."

"Why that long? It sounded simple enough, the way you said it."

"Because great laws are not divined by flashes of inspiration, whatever you may think. It usually takes the combined work of a world full of scientists over a period of centuries. After Genovi 41 discovered that Lagash rotated about the sun Alpha, rather than vice versa—and that was four hundred years ago—astronomers have been working. The complex motions of the six suns were recorded and analyzed and unwoven. Theory after theory was advanced and checked and counter-checked and modified and abandoned and revived and converted to something else. It was a devil of a job."

Thereumon nodded thoughtfully and held out his glass for more liquor. Sheerin grudgingly allowed a few ruby drops to leave the bottle.

"It was twenty years ago," he continued after remoistening his own throat, "that it was finally demonstrated that the Law of Universal Gravitation accounted exactly for the orbital motions of the six suns. It was a great triumph."

Sheerin stood up and walked to the window, still clutching his bottle, "And now we're getting to the point. In the last decade, the motions of Lagash about Alpha were computed according to gravity, and *it did not account for the orbit observed*; not even when all perturbations due to the other suns were included. Either the law was invalid, or there was another, as yet unknown, factor involved."

THEREMON joined Sheerin at the window and gazed out past the wooded slopes to where the spires of Saro City gleamed bloodily on the horizon. The newsman felt the ten-



sion of uncertainty grow within him as he cast a short glance at Beta. It glowered redly at zenith, dwarfed and evil.

"Go ahead, sir," he said softly.

Sheerin replied, "Astronomers stumbled about for years, each proposed theory more untenable than the one before—until Aton had the inspiration of calling in the Cult. The head of the Cult, Sor 5, had access to certain data that simplified

the problem considerably. Aton set to work on a new track.

"What if there were another non-luminous planetary body such as Lagash? If there were, you know, it would shine only by reflected light, and if it were composed of bluish rock, as Lagash itself largely is, then, in the redness of the sky, the eternal blaze of the suns would make it invisible—drown it out completely."

Theremon whistled, "What a screwy idea!"

"You think *that's* screwy? Listen to this: Suppose this body rotated about Lagash at such a distance and in such an orbit and had such a mass that its attraction would exactly account for the deviations of Lagash's orbit from theory—do you know what would happen?"

The columnist shook his head.

"Well, sometimes this body would get in the way of a sun." And Sheerin emptied what remained in the bottle at a draft.

"And it does, I suppose," said Theremon flatly.

"Yes! But only one sun lies in its plane of revolutions." He jerked a thumb at the shrunken sun above. "Beta! And it has been shown that the eclipse will occur only when the arrangement of the suns is such that Beta is alone in its hemisphere and at maximum distance, at which time the moon is invariably at minimum distance. The eclipse that results, with the moon seven times the apparent diameter of Beta, covers all of Lagash and lasts well over half a day, so that no spot on the planet escapes the effects. *That eclipse comes once every two thousand and forty-nine years.*"

Theremon's face was drawn into an expressionless mask. "And that's my story?"

The psychologist nodded. "That's all of it. First the eclipse—which

will start in three quarters of an hour—then universal Darkness, and, maybe, these mysterious Stars—then madness, and end of the cycle.”

He brooded. “We had two months’ leeway—we at the Observatory—and that wasn’t enough time to persuade Lagash of the danger. Two centuries might not have been enough. But our records are at the Hideout, and today we photograph the eclipse. The next cycle will *start off* with the truth, and when the *next* eclipse comes, mankind will at last be ready for it. Come to think of it, that’s part of your story, too.”

A thin wind ruffled the curtains at the window as Theremon opened it and leaned out. It played coldly with his hair as he stared at the crimson sunlight on his hand. Then he turned in sudden rebellion.

“What is there in Darkness to drive *me* mad?”

Sheerin smiled to himself as he spun the empty liquor bottle with abstracted motions of his hand. “Have you ever experienced Darkness, young man?”

The newsman leaned against the wall and considered. “No. Can’t say I have. But I know what it is. Just—uh—” He made vague motions with his fingers, and then brightened. “Just no light. Like in caves.”

“Have you ever been in a cave?”

“In a *cavel*. Of course not!”

“I thought not. *I* tried last week—just to see—but I got out in a hurry. I went in until the mouth of the cave was just visible as a blur of light, with black everywhere else. I never thought a person my weight could run that fast.”

Theremon’s lip curled. “Well, if it comes to that, I guess I wouldn’t have run, if I had been there.”

The psychologist studied the young man with an annoyed frown. “My, don’t you talk big! I dare you to draw the curtain.”

Theremon looked his surprise and said, “What for? If we had four or five suns out there we might want to cut the light down a bit for comfort, but now we haven’t enough light as it is.”

“That’s the point. Just draw the curtain; then come here and sit down.”

“All right.” Theremon reached for the tasseled string and jerked. The red curtain slid across the wide window, the brass rings hissing their way along the crossbar, and a dusky shadow clamped down on the room.

THEREMON’S footsteps sounded hollowly in the silence as he made his way to the table, and then they stopped halfway. “I can’t see you, sir,” he whispered.

“Feel your way,” ordered Sheerin in a strained voice.

“But I can’t see you, sir.” The newsman was breathing harshly. “I can’t see anything.”

“What did you expect?” came the grim reply. “Come here and sit down!”

The footsteps sounded again, waveringly, approaching slowly. There was the sound of someone fumbling with a chair. Theremon’s voice came thinly, “Here I am. I feel . . . *ulp* . . . all right.”

“You like it, do you?”

“N-no. It’s pretty awful. The walls seem to be—” He paused. “They seem to be closing in on me. I keep wanting to push them away. But I’m not going *mad*! In fact, the feeling isn’t as bad as it was.”

“All right. Draw the curtain back again.”

There were cautious footsteps

through the dark, the rustle of Theremon's body against the curtain as he felt for the tassels, and then the triumphant *ro-o-o-osh* of the curtain slithering back. Red light flooded the room, and with a cry of joy Theremon looked up at the sun.

Sheerin wiped the moistness off his forehead with the back of a hand and said shakily, "And that was just a dark room."

"It can be stood," said Theremon lightly.

"Yes, a dark room can. But were you at the Jonglor Centennial Exposition two years ago?"

"No, it so happens I never got around to it. Six thousand miles was just a bit too much to travel, even for the exposition."

"Well, I was there. You remember hearing about the 'Tunnel of Mystery' that broke all records in the amusement area—for the first month or so, anyway?"

"Yes. Wasn't there some fuss about it?"

"Very little. It was hushed up. You see, that Tunnel of Mystery was just a mile-long tunnel—with no lights. You got into a little open car and jolted along through Darkness for fifteen minutes. It was very popular—while it lasted."

"Popular?"

"Certainly. There's a fascination in being frightened *when it's part of a game*. A baby is born with three instinctive fears: of loud noises, of falling, and of the absence of light. That's why it's considered so funny to jump at someone and shout 'Boo!' That's why it's such fun to ride a roller coaster. And that's why that Tunnel of Mystery started cleaning up. People came out of that Darkness shaking, breathless, half dead with fear, but they kept on paying to get in."

"Wait a while, I remember now.

Some people came out dead, didn't they? There were rumors of that after it shut down."

The psychologist snorted. "Bah! Two or three died. That was nothing! They paid off the families of the dead ones and argued the Jonglor City Council into forgetting it. After all, they said, if people with weak hearts want to go through the tunnel, it was at their own risk—and besides, it wouldn't happen again. So they put a doctor in the front office and had every customer go through a physical examination before getting into the car. That actually *boosted* ticket sales."

"Well, then?"

"But, you see, there was something else. People sometimes came out in perfect order, except that they refused to go into buildings—any buildings; including palaces, mansions, apartment houses, tenements, cottages, huts, shacks, lean-tos, and tents."

Theremon looked shocked. "You mean they refused to come in out of the open. Where'd they sleep?"

"In the open."

"They should have *forced* them inside."

"Oh, they did, they did. Whereupon these people went into violent hysterics and did their best to bat their brains out against the nearest wall. Once you got them inside, you couldn't keep them there without a strait jacket and a shot of morphine."

"They must have been crazy."

"Which is exactly what they were. One person out of every ten who went into that tunnel came out that way. They called in the psychologists, and we did the only thing possible. We closed down the exhibit." He spread his hands.

"What was the matter with these people?" asked Theremon finally.

"Essentially the same thing that was the matter with you when you thought the walls of the room were crushing in on you in the dark. There is a psychological term for mankind's instinctive fear of the absence of light. We call it 'claustrophobia,' because the lack of light is always tied up with inclosed places, so that fear of one is fear of the other. You see?"

"And those people of the tunnel?"

"Those people of the tunnel consisted of those unfortunates whose mentality did not quite possess the resiliency to overcome the claustrophobia that overtook them in the Darkness. Fifteen minutes without light is a long time; you only had two or three minutes, and I believe you were fairly upset.

"The people of the tunnel had what is called a 'claustrophobic fixation.' Their latent fear of Darkness and inclosed places had crystallized and become active, and, as far as we can tell, permanent. *That's* what fifteen minutes in the dark will do."

THERE WAS a long silence, and Theremon's forehead wrinkled slowly into a frown. "I don't believe it's that bad."

"You mean you don't want to believe," snapped Sheerin. "You're afraid to believe. Look out the window!"

Theremon did so, and the psychologist continued without pausing, "Imagine Darkness — everywhere. No light, as far as you can see. The houses, the trees, the fields, the earth, the sky—*black!* And Stars thrown in, for all I know—whatever *they* are. Can you conceive it?"

"Yes, I can," declared Theremon truculently.

And Sheerin slammed his fist down upon the table in sudden passion. "You lie! You can't conceive

that. Your brain wasn't built for the conception any more than it was built for the conception of infinity or of eternity. You can only talk about it. A fraction of the reality upsets you, and when the real thing comes, your brain is going to be presented with a phenomenon outside its limits of comprehension. You will go mad, completely and permanently! There is no question of it!"

He added sadly, "And another couple of milleniums of painful struggle comes to nothing. Tomorrow there won't be a city standing unharmed in all Lagash."

Theremon recovered part of his mental equilibrium. "That doesn't follow. I still don't see that I can go loony just because there isn't a Sun in the sky—but even if I did, and everyone else did, how does that harm the cities? Are we going to blow them down?"

But Sheerin was angry, too. "If you were in Darkness, what would you want more than anything else; what would it be that every instinct would call for? Light, damn you, *light!*"

"Well?"

"And how would you get light?"

"I don't know," said Theremon flatly.

"What's the *only* way to get light, short of the sun?"

"How should I know?"

They were standing face to face and nose to nose.

Sheerin said, "You burn something, mister. Ever see a forest fire? Ever go camping and cook a stew over a wood fire? Heat isn't the only thing burning wood gives off, you know. It gives off light, and people know that. And when it's dark they want light, and they're going to *get it.*"

"So they burn wood?"

"So they burn whatever they can

get. They've got to have light. They've got to burn something, and wood isn't handy—so they'll burn whatever is nearest. They'll have their light—and every center of habitation goes up in flames!”

Eyes held each other as though the whole matter were a personal affair of respective will powers, and then Theremon broke away wordlessly. His breathing was harsh and ragged, and he scarcely noted the sudden hubbub that came from the adjoining room behind the closed door.

Sheerin spoke, and it was with an effort that he made it sound matter-of-fact. “I think I heard Yimot's voice. He and Faro are probably back. Let's go in and see what kept them.”

“Might as well!” muttered Theremon. He drew a long breath and seemed to shake himself. The tension was broken.

THE ROOM was in an uproar, with members of the staff clustering about two young men who were removing outer garments even as they parried the miscellany of questions being thrown at them.

Aton bustled through the crowd and faced the newcomers angrily. “Do you realize that it's less than half an hour before deadline. Where have you two been?”

Faro 24 seated himself and rubbed his hands. His cheeks were red with the outdoor chill. “Yimot and I have just finished carrying through a little crazy experiment of our own. We've been trying to see if we couldn't construct an arrangement by which we could simulate the appearance of Darkness and Stars so as to get an advance notion as to how it looked.”

There was a confused murmur from the listeners, and a sudden look

of interest entered Aton's eyes. “There wasn't anything said of this before. How did you go about it?”

“Well,” said Faro, “the idea came to Yimot and myself long ago, and we've been working it out in our spare time. Yimot knew of a low one-story house down in the city with a domed roof—it had once been used as a museum, I think. Anyway, we bought it—”

“Where did you get the money?” interrupted Aton peremptorily.

“Our bank accounts,” grunted Yimot 70. “It cost two thousand credits.” Then, defensively, “Well, what of it? Tomorrow, two thousand credits will be two thousand pieces of paper. That's all.”

“Sure,” agreed Faro. “We bought the place and rigged it up with black velvet from top to bottom so as to get as perfect a Darkness as possible. Then we punched tiny holes in the ceiling and through the roof and covered them with little metal caps, all of which could be shoved aside simultaneously at the close of a switch. At least, we didn't do that part ourselves; we got a carpenter and an electrician and some others—money didn't count. The point was that we could get the light to shine through those holes in the roof, so that we could get a starlike effect.”

Not a breath was drawn during the pause that followed. Aton said stiffly:

“You had no right to make a private—”

Faro seemed abashed. “I know, sir—but, frankly, Yimot and I thought the experiment was a little dangerous. If the effect really worked, we half expected to go mad—from what Sheerin says about all this, we thought that would be rather likely. We wanted to take the risk ourselves. Of course, if we

found we could retain sanity, it occurred to us that we might develop immunity to the real thing, and then expose the rest of you to the same thing. But things didn't work out at all—"

"Why, what happened?"

It was Yimot who answered. "We shut ourselves in and allowed our eyes to get accustomed to the dark. It's an extremely creepy feeling because the total Darkness makes you feel as if the walls and ceiling are crushing in on you. But we got over that and pulled the switch. The caps fell away and the roof glittered all over with little dots of light—"

"Well?"

"Well—nothing. That was the whacky part of it. Nothing happened. It was just a roof with holes in it, and that's just what it looked like. We tried it over and over again—that's what kept us so late—but there just isn't any effect at all."

There followed a shocked silence, and all eyes turned to Sheerin, who sat motionless, mouth open.

Theremon was the first to speak. "You know what this does to this whole theory you've built up, Sheerin, don't you?" He was grinning with relief.

But Sheerin raised his hand. "Now wait a while. Just let me think this through." And then he snapped his fingers, and when he lifted his head there was neither surprise nor uncertainty in his eyes. "Of course—"

He never finished. From somewhere up above there sounded a sharp clang, and Beenay, starting to his feet, dashed up the stairs with a "What the devil!"

The rest followed after.

THINGS happened quickly. Once up in the dome, Beenay cast one horrified glance at the shattered photographic plates and at the man bend-

ing over them; and then hurled himself fiercely at the intruder, getting a death grip on his throat. There was a wild threshing, and as others of the staff joined in, the stranger was swallowed up and smothered under the weight of half a dozen angry men.

Aton came up last, breathing heavily. "Let him up!"

There was a reluctant unscrambling and the stranger, panting harshly, with his clothes torn and his forehead bruised, was hauled to his feet. He had a short yellow beard curled elaborately in the style affected by the Cultists.

Beenay shifted his hold to a collar grip and shook the man savagely. "All right, rat, what's the idea? These plates—"

"I wasn't after *them*," retorted the Cultist coldly. "That was an accident."

Beenay followed his glowering stare and snarled, "I see. You were after the cameras themselves. The accident with the plates was a stroke of luck for you, then. If you had touched Snapping Bertha or any of the others, you would have died by slow torture. As it is—" He drew his fist back.

Aton grabbed his sleeve. "Stop that! Let him go!"

The young technician wavered, and his arm dropped reluctantly. Aton pushed him aside and confronted the Cultist. "You're Latimer, aren't you?"

The Cultist bowed stiffly and indicated the symbol upon his hip. "I am Latimer 25, adjutant of the third class to his serenity, Sor 5."

"And"—Aton's white eyebrows lifted—"you were with his serenity when he visited me last week, weren't you?"

Latimer bowed a second time.

"Now, then, what do you want?"

"Nothing that you would give me of your own free will."

"Sor 5 sent you, I suppose—or is this your own idea?"

"I won't answer that question."

"Will there be any further visitors?"

"I won't answer that, either."

Aton glanced at his timepiece and scowled. "Now, man, what is it your master wants of me. I have fulfilled my end of the bargain."

Latimer smiled faintly, but said nothing.

"I asked him," continued Aton angrily, "for data only the Cult could supply, and it was given to me. For that, thank you. In return, I promised to prove the essential truth of the creed of the Cult."

"There was no need to prove that," came the proud retort. "It stands proven by the 'Book of Revelations.'"

"For the handful that constitute the Cult, yes. Don't pretend to mistake my meaning. I offered to present scientific backing for your beliefs. And I did!"

The Cultist's eyes narrowed bitterly. "Yes, you did—with a fox's subtlety, for your pretended explanation backed our beliefs, and at the same time removed all necessity for them. You made of the Darkness and of the Stars a natural phenomenon, and removed all its real significance. That was blasphemy."

"If so, the fault isn't mine. The facts exist. What can I do but state them?"

"Your 'facts' are a fraud and a delusion."

Aton stamped angrily. "How do you know?"

And the answer came with the certainty of absolute faith. "I know!"

The director purpled and Beenay whispered urgently. Aton waved him silent. "And what does Sor 5

want us to do. He still thinks, I suppose, that in trying to warn the world to take measures against the menace of madness, we are placing innumerable souls in jeopardy. We aren't succeeding, if that means anything to him."

"The attempt itself has done harm enough, and your vicious effort to gain information by means of your devilish instruments must be stopped. We obey the will of their Stars, and I only regret that my clumsiness prevented me from wrecking your infernal devices."

"It wouldn't have done you too much good," returned Aton. "All our data, except for the direct evidence, we intend collecting right now, is already safely cached and well beyond possibility of harm." He smiled grimly. "But that does not affect your present status as an attempted burglar and criminal."

He turned to the men behind him. "Someone call the police at Saro City."

THERE WAS a cry of distaste from Sheerin. "Damn it, Aton, what's wrong with you? There's no time for that. Here"—he bustled his way forward—"let me handle this."

Aton stared down his nose at the psychologist. "This is not the time for your monkeyshines, Sheerin. Will you please let me handle this my own way? Right now you are a complete outsider here, and don't forget it."

Sheerin's mouth twisted eloquently. "Now why should we go to the impossible trouble of calling the police—with Beta's eclipse a matter of minutes from now—when this young man here is perfectly willing to pledge his word of honor to remain and cause no trouble whatsoever."

The Cultist answered promptly,

"I will do no such thing. You're free to do what you want, but it's only fair to warn you that just as soon as I get my chance I'm going to finish what I came out here to do. If it's my word of honor you're relying on, you'd better call the police."

Sheerin smiled in a friendly fashion. "You're a determined cuss, aren't you? Well, I'll explain something. Do you see that young man at the window? He's a strong, husky fellow, quite handy with his fists, and he's an outsider besides. Once the eclipse starts there will be nothing for him to do except keep an eye on you. Besides him, there will be myself—a little too stout for active fisticuffs, but still able to help."

"Well, what of it?" demanded Latimer frozenly.

"Listen and I'll tell you," was the reply. "Just as soon as the eclipse starts, we're going to take you, Theremon and I, and deposit you in a little closet with one door, to which is attached one giant lock and no windows. You will remain there for duration."

"And afterward," breathed Latimer fiercely, "there'll be no one to let me out. I know as well as you do what the coming of the Stars means—I know it far better than you. With all your minds gone, you are not likely to free me. Suffocation or slow starvation, is it? About what I might have expected from a group of scientists. But I don't give my word. It's a matter of principle, and I won't discuss it further."

Aton seemed perturbed. His faded eyes were troubled. "Really, Sheerin, locking him—"

"Please!" Sheerin motioned him impatiently to silence. "I don't think for a moment things will go that far. Latimer has just tried a clever little bluff, but I'm not a psychologist just because I like the

sound of the word." He grinned at the Cultist. "Come now, you don't really think I'm trying anything as crude as slow starvation. My dear Latimer, if I lock you in the closet, you are not going to see the Darkness, and you are not going to see the Stars. It does not take much of a knowledge of the fundamental creed of the Cult to realize that for you to be hidden from the Stars when they appear means the loss of your immortal soul. Now, I believe you to be an honorable man. I'll accept your word of honor to make no further effort to disrupt proceedings if you'll offer it."

A vein throbbed in Latimer's temple, and he seemed to shrink within himself as he said thickly, "You have it!" And then he added with swift fury, "But it is my consolation that you will all be damned for your deeds of today." He turned on his heel and stalked to the high three-legged stool by the door.

Sheerin nodded to the columnist. "Take a seat next to him, Theremon—just as a formality. Hey, Theremon!"

But the newspaperman didn't move. He had gone pale to the lips. "Look at that!" The finger he pointed toward the sky shook, and his voice was dry and cracked.

THERE WAS one simultaneous gasp as every eye followed the pointing finger and, for one breathless moment, stared frozenly.

Beta was chipped on one side!

The tiny bit of encroaching blackness was perhaps the width of a fingernail, but to the staring watchers it magnified itself into the crack of doom.

Only for a moment they watched, and after that there was a shrieking confusion that was even shorter of duration and which gave way to

an orderly scurry of activity—each man at his prescribed job. At the crucial moment there was no time for emotion. The men were merely scientists with work to do. Even Aton had melted away.

Sheerin said prosaically, "First contact must have been made fifteen minutes ago. A little early, but pretty good considering the uncertainties involved in the calculation." He looked about him and then tiptoed to Theremon, who still remained staring out the window, and dragged him away gently.

"Aton is furious," he whispered, "so stay away. He missed first contact on account of this fuss with Latimer, and if you get in his way he'll have you thrown out the window."

Theremon nodded shortly and sat down. Sheerin stared in surprise at him.

"The devil, man," he exclaimed, "you're shaking."

"Eh?" Theremon licked dry lips and then tried to smile. "I don't feel very well, and that's a fact."

The psychologist's eyes hardened. "You're not losing your nerve?"

"No!" cried Theremon in a flash of indignation. "Give me a chance, will you? I haven't really believed this rigmarole—not way down beneath, anyway—till just this minute. Give me a chance to get used to the idea. *You've* been preparing yourself for two months or more."

"You're right, at that," replied Sheerin thoughtfully. "Listen! Have you got a family—parents, wife, children?"

Theremon shook his head. "You mean the Hideout, I suppose. No, you don't have to worry about that. I have a sister, but she's two thousand miles away. I don't even know her exact address."

"Well, then, what about yourself?

You've got time to get there, and they're one short anyway, since I left. After all, you're not needed here, and you'd make a darned fine addition—"

Theremon looked at the other wearily. "You think I'm scared stiff, don't you? Well, get this, mister, I'm a newspaperman and I've been assigned to cover a story. I intend covering it."

There was a faint smile on the psychologist's face. "I see. Professional honor, is that it?"

"You might call it that. But, man, I'd give my right arm for another bottle of that sockeroo juice even half the size of the one *you* hogged. If ever a fellow needed a drink, I do."

He broke off. Sheerin was nudging him violently. "Do you hear that? Listen!"

Theremon followed the motion of the other's chin and stared at the Cultist, who, oblivious to all about him, faced the window, a look of wild elation on his face, droning to himself the while in singsong fashion.

"What's he saying?" whispered the columnist.

"He's quoting 'Book of Revelations,' fifth chapter," replied Sheerin. Then, urgently, "Keep quiet and listen, I tell you."

The Cultist's voice had risen in a sudden increase of fervor:

"And it came to pass that in those days the Sun, Beta, held lone vigil in the sky for ever longer periods as the revolutions passed; until such time as for full half a revolution, it alone, shrunken and cold, shone down upon Lagash.

"And men did assemble in the public squares and in the highways, there to debate and to marvel at the sight, for a strange depression had seized them. Their minds were trou-

bled and their speech confused, for the souls of men awaited the coming of the Stars.

“‘And in the city of Trigon, at high noon, Vendret 2 came forth and said unto the men of Trigon, “Lo, ye sinners! Though ye scorn the ways of righteousness, yet will the time of reckoning come. Even now the Cave approaches to swallow Lagash; yea, and all it contains.”

“‘And even as he spoke the lip of the Cave of Darkness passed the edge of Beta so that to all Lagash it was hidden from sight. Loud were the cries of men as it vanished, and great the fear of soul that fell upon them.

“‘It came to pass that the Darkness of the Cave fell upon Lagash, and there was no light on all the surface of Lagash. Men were even as blinded, nor could one man see his neighbor, though he felt his breath upon his face.

“‘And in this blackness their appeared the Stars, in countless numbers, and to the strains of ineffable music of a beauty so wondrous that the very leaves of the trees turned to tongues that cried out in wonder.

“‘And in that moment the souls of men departed from them, and their abandoned bodies became even as beasts; yea, even as brutes of the wild; so that through the blackened streets of the cities of Lagash they prowled with wild cries.

“‘From the Stars there then reached down the Heavenly Flame, and where it touched, the cities of Lagash flamed to utter destruction, so that of man and of the works of man nought remained.

“‘Even then—’”

THERE WAS a subtle change in Latimer's tone. His eyes had not shifted, but somehow he had become aware of the absorbed attention of

the other two. Easily, without pausing for breath, the timber of his voice shifted and the syllables became more liquid.

Thereumon, caught by surprise, stared. The words seemed on the border of familiarity. There was an elusive shift in the accent, a tiny change in the vowel stress; nothing more—yet Latimer had become thoroughly unintelligible.

Sheerin smiled slyly. “He shifted to some old-cycle tongue, probably their traditional second cycle. That was the language in which the ‘Book of Revelations’ had originally been written, you know.”



"It doesn't matter; I've heard enough." Theremon shoved his chair back and brushed his hair back with hands that no longer shook. "I feel much better now."

"You do?" Sheerin seemed mildly surprised.

"I'll say I do. I had a bad case of jitters just a while back. Listening to you and your gravitation and seeing that eclipse start almost finished me. But this"—he jerked a contemptuous thumb at the yellow-bearded Cultist—"this is the sort of thing my nurse used to tell me. I've been laughing at that sort of thing all my life. I'm not going to let it scare me now."

He drew a deep breath and said with a hectic gaiety, "But if I expect to keep on the good side of myself, I'm going to turn my chair away from the window."

Sheerin said, "Yes, but you'd better talk lower. Aton just lifted his head out of that box he's got it stuck into and gave you a look that should have killed you."

Theremon made a mouth. "I forgot about the old fellow." With elaborate care he turned the chair from the window, cast one distasteful look over his shoulder and said, "It has occurred to me that there must be considerable immunity against this Star madness."

The psychologist did not answer immediately. Beta was past its zenith now, and the square of bloody sunlight that outlined the window upon the floor had lifted into Sheerin's lap. He stared at its dusky color thoughtfully and then bent and squinted into the sun itself.

The chip in its side had grown to a black encroachment that covered a third of Beta. He shuddered, and when he straightened once more his florid cheeks did not contain quite

as much color as they had had previously.

With a smile that was almost apologetic, he reversed his chair also. "There are probably two million people in Saro City that are all trying to join the Cult at once in one gigantic revival." Then, ironically, "The Cult is in for an hour of unexampled prosperity. I trust they'll make the most of it. Now, what was it you said?"

"Just this. How do the Cultists manage to keep the 'Book of Revelations' going from cycle to cycle, and how on Lagash did it get written in the first place? There must have been some sort of immunity, for if everyone had gone mad, who would be left to write the book?"

Sheerin stared at his questioner ruefully. "Well, now, young man, there isn't any eyewitness answer to that, but we've got a few damned good notions as to what happened. You see, there are three kinds of people who might remain relatively unaffected. First, the very few who don't see the Stars at all; the blind, those who drink themselves into a stupor at the beginning of the eclipse and remain so to the end. We leave them out—because they aren't really witnesses.

"Then there are children below six, to whom the world as a whole is too new and strange for them to be too frightened at Stars and Darkness. They would be just another item in an already surprising world. You see that, don't you?"

The other nodded doubtfully. "I suppose so."

"Lastly, there are those whose minds are too coarsely grained to be entirely toppled. The very insensitive would be scarcely affected—oh, such people as some of our older, work-broken peasants. Well, the children would have fugitive memo-

ries, and that, combined with the confused, incoherent babblings of the half-mad morons, formed the basis for the 'Book of Revelations.'

"Naturally, the book was based, in the first place, on the testimony of those least qualified to serve as historians; that is, children and morons; and was probably extensively edited and re-edited through the cycles."

"Do you suppose," broke in Theremon, "that they carried the book through the cycles the way we're planning on handing on the secret of gravitation?"

Sheerin shrugged. "Perhaps, but their exact method is unimportant. They do it, somehow. The point I was getting at was that the book can't help but be a mass of distortion, even if it is based on fact. For instance, do you remember the experiment with the holes in the roof that Faro and Yimot tried—the one that didn't work?"

"Yes."

"You know why it didn't w—" He stopped and rose in alarm, for Aton was approaching, his face a twisted mask of consternation. "*What's happened?*"

ATON DREW HIM *aside* and Sheerin could feel the fingers on his elbow twitching.

"Not so loud!" Aton's voice was low and tortured. "I've just gotten word from the Hideout on the private line."

Sheerin broke in anxiously, "They are in trouble?"

"Not *they*." Aton stressed the pronoun significantly. "They sealed themselves off just a while ago, and they're going to stay buried till day after tomorrow. They're safe. But the *city*, Sheerin—it's a shambles. You have no idea—" He was having difficulty in speaking.

"Well?" snapped Sheerin impa-

tiently. "What of it? It will get worse. What are you shaking about?" Then, suspiciously, "How do you feel?"

Aton's eyes sparked angrily at the insinuation, and then faded to anxiety once more. "You don't understand. The Cultists are active. They're rousing the people to storm the Observatory—promising them immediate entrance into grace, promising them salvation, promising them anything. What are we to do, Sheerin?"

Sheerin's head bent, and he stared in long abstraction at his toes. He tapped his chin with one knuckle, then looked up and said crisply, "Do? What is there to do? Nothing at all! Do the men know of this?"

"No, of course not!"

"Good! Keep it that way. How long till totality?"

"Not quite an hour."

"There's nothing to do but gamble. It will take time to organize any really formidable mob, and it will take more time to get them out here. We're a good five miles from the city—"

He glared out the window, down the slopes to where the farmed patches gave way to clumps of white houses in the suburbs; down to where the metropolis itself was a blur on the horizon—a mist in the waning blaze of Beta.

He repeated without turning, "It will take time. Keep on working and pray that totality comes first."

Beta was cut in half, the line of division pushing a slight concavity into the still-bright portion of the Sun. It was like a gigantic eyelid shutting slantwise over the light of a world.

The faint clatter of the room in which he stood faded into oblivion, and he sensed only the thick silence

of the fields outside. The very insects seemed frightened mute. And things were dim.

He jumped at the voice in his ear. Theremon said, "Is something wrong?"

"Eh? Er—no. Get back to the chair. We're in the way." They slipped back to their corner, but the psychologist did not speak for a time. He lifted a finger and loosened his collar. He twisted his neck back and forth but found no relief. He looked up suddenly.

"Are you having any difficulty in breathing?"

The newspaperman opened his eyes wide and drew two or three long breaths. "No. Why?"

"I looked out the window too long, I suppose. The dimness got me. Difficulty in breathing is one of the first symptoms of a claustrophobic attack."

Theremon drew another long breath. "Well, it hasn't got me yet. Say, here's another of the fellows."

BEENAY had interposed his bulk between the light and the pair in the corner, and Sheerin squinted up at him anxiously. "Hello, Beenay."

The astronomer shifted his weight to the other foot and smiled feebly. "You won't mind if I sit down awhile and join in on the talk. My cameras are set, and there's nothing to do till totality." He paused and eyed the Cultist, who fifteen minutes earlier had drawn a small, skin-bound book from his sleeve and had been poring intently over it ever since. "That rat hasn't been making trouble, has he?"

Sheerin shook his head. His shoulders were thrown back and he frowned his concentration as he forced himself to breathe regularly. He said, "Have you had any trouble breathing, Beenay?"

Beenay sniffed the air in his turn. "It doesn't seem stuffy to me."

"A touch of claustrophobia," explained Sheerin apologetically.

"Oh-h-h! It worked itself differently with me. I get the impression that my eyes are going back on me. Things seem to blur and—well, nothing is clear. And it's cold, too."

"Oh, it's cold, all right. That's no illusion." Theremon grimaced. "My toes feel as if I've been shipping them cross country in a refrigerating car."

"What we need," put in Sheerin, "is to keep our minds busy with extraneous affairs. I was telling you a while ago, Theremon, why Faro's experiments with the holes in the roof came to nothing."

"You were just beginning," replied Theremon. He encircled a knee with both arms and nuzzled his chin against it.

"Well, as I started to say, they were misled by taking the 'Book of Revelations' literally. There probably wasn't any sense in attaching any physical significance to the Stars. It might be, you know, that in the presence of total Darkness, the mind finds it absolutely necessary to create light. This illusion of light might be all the Stars there really are."

"In other words," interposed Theremon, "you mean the Stars are the results of the madness and not one of the causes. Then, what good will Beenay's photographs be?"

"To prove that it is an illusion, maybe; or to prove the opposite, for all I know. Then again—"

But Beenay had drawn his chair closer, and there was an expression of sudden enthusiasm on his face. "Say, I'm glad you two got on to this subject." His eyes narrowed and he lifted one finger. "I've been thinking about these Stars and I've

got a really cute notion. Of course, it's strictly ocean foam, and I'm not trying to advance it seriously, but I think it's interesting. Do you want to hear it?"

He seemed half reluctant, but Sheerin leaned back and said, "Go ahead! I'm listening."

"Well, then, supposing there were other suns in the universe." He broke off a little bashfully. "I mean suns that are so far away that they're too dim to see. It sounds as if I've been reading some of that fantastic fiction, I suppose."

"Not necessarily. Still, isn't that possibility eliminated by the fact that, according to the Law of Gravitation, they would make themselves evident by their attractive forces?"

"Not if they were far enough off," rejoined Beenay, "really far off—maybe as much as four light years, or even more. We'd never be able to detect perturbations then, because they'd be too small. Say that there were a lot of suns that far off; a dozen or two, maybe."

Thereupon whistled melodiously. "What an idea for a good Sunday supplement article. Two dozen suns in a universe eight light years across. Wow! That would shrink *our* universe into insignificance. The readers would eat it up."

"Only an idea," said Beenay with a grin, "but you see the point. During eclipse, these dozen suns would become visible, because there'd be no *real* sunlight to drown them out. Since they're so far off, they'd appear small, like so many little marbles. Of course, the Cultists talk of millions of Stars, but that's probably exaggeration. There just isn't any place in the universe you could put a million suns—unless they touch each other."

Sheerin had listened with gradually increasing interest. "You've hit

something there, Beenay. And exaggeration is just exactly what would happen. Our minds, as you probably know, can't grasp directly any number higher than five; above that there is only the concept of 'many.' A dozen would become a million just like that. A damn good idea!"

"AND I've got another cute little notion," Beenay said. "Have you ever thought what a simple problem gravitation would be if only you had a sufficiently simple system? Supposing you had a universe in which there was a planet with only one sun. The planet would travel in a perfect ellipse and the exact nature of the gravitational force would be so evident it could be accepted as an axiom. Astronomers on such a world would start off with gravity probably before they even invent the telescope. Naked-eye observation would be enough."

"But would such a system be dynamically stable?" questioned Sheerin doubtfully.

"Sure! They call it the 'one-and-one' case. It's been worked out mathematically, but it's the philosophical implications that interest me."

"It's nice to think about," admitted Sheerin, "as a pretty abstraction—like a perfect gas or absolute zero."

"Of course," continued Beenay, "there's the catch that life would be impossible on such a planet. It wouldn't get enough heat and light, and if it rotated there would be total Darkness half of each day. You couldn't expect life—which is fundamentally dependent upon light—to develop under those conditions. Besides—"

Sheerin's chair went over backward as he sprang to his feet in a

rude interruption. "Aton's brought out the lights."

Beenay said, "Huh," turned to stare, and then grinned halfway around his head in open relief.

There were half a dozen foot-long, inch-thick rods cradled in Aton's arms. He glared over them at the assembled staff members.

"Get back to work, all of you. Sheerin, come here and help me!"

Sheerin trotted to the older man's side and, one by one, in utter silence, the two adjusted the rods in makeshift metal holders suspended from the walls.

With the air of one carrying through the most sacred item of a religious ritual, Sheerin scraped a large, clumsy match into spluttering life and passed it to Aton, who carried the flame to the upper end of one of the rods.

It hesitated there a while, playing futilely about the tip, until a sudden, crackling flare cast Aton's lined face into yellow highlights. He withdrew the match and a spontaneous cheer rattled the window.

The rod was topped by six inches of wavering flame! Methodically, the other rods were lighted, until six independent fires turned the rear of the room yellow.

The light was dim, dimmer even than the tenuous sunlight. The flames reeled crazily, giving birth to drunken, swaying shadows. The torches smoked devilishly and smelled like a bad day in the kitchen. But they emitted yellow light.

There is something to yellow light—after four hours of somber, dimming Beta. Even Latimer had lifted his eyes from his book and stared in wonder.

Sheerin warmed his hands at the nearest, regardless of the soot that gathered upon them in a fine, gray powder, and muttered ecstatically to

himself. "Beautiful! Beautiful! I never realized before what a wonderful color yellow is."

But Theremon regarded the torches suspiciously. He wrinkled his nose at the rancid odor, and said, "What are those things?"

"Wood," said Sheerin shortly.

"Oh, no, they're not. They aren't burning. The top inch is charred and the flame just keeps shooting up out of nothing."

"That's the beauty of it. This is a really efficient artificial-light mechanism. We made a few hundred of them, but most went to the Hideout, of course. You see"—he turned and wiped his blackened hands upon his handkerchief—"you take the pithy core of coarse water reeds, dry them thoroughly and soak them in animal grease. Then you set fire to it and the grease burns, little by little. These torches will burn for almost half an hour without stopping. Ingenious, isn't it? It was developed by one of our own young men at Saro University."

AFTER THE momentary sensation, the dome had quieted. Latimer had carried his chair directly beneath a torch and continued reading, lips moving in the monotonous recital of invocations to the Stars. Beenay had drifted away to his cameras once more, and Theremon seized the opportunity to add to his notes on the article he was going to write for the *Saro City Chronicle* the next day—a procedure he had been following for the last two hours in a perfectly methodical, perfectly conscientious and, as he was well aware, perfectly meaningless fashion.

But, as the gleam of amusement in Sheerin's eyes indicated, careful note taking occupied his mind with something other than the fact that the sky was gradually turning a hor-

rible deep purple-red, as if it were one gigantic, freshly peeled beet; and so it fulfilled its purpose.

The air grew, somehow, denser. Dusk, like a palpable entity, entered the room, and the dancing circle of yellow light about the torches etched itself into ever-sharper distinction against the gathering grayness beyond. There was the odor of smoke and the presence of little chuckling sounds that the torches made as they burned; the soft pad of one of the men circling the table at which he worked, on hesitant tiptoes; the occasional indrawn breath of someone trying to retain composure in a world that was retreating into the shadow.

It was Theremon who first heard the extraneous noise. It was a vague, unorganized *impression* of sound that would have gone unnoticed but for the dead silence that prevailed within the dome.

The newsman sat upright and replaced his notebook. He held his breath and listened; then, with considerable reluctance, threaded his way between the solaroscope and one of Beenay's cameras and stood before the window.

The silence ripped to fragments at his startled shout:

"*Sheerin!*"

Work stopped! The psychologist was at his side in a moment. Aton joined him. Even Yimot 70, high in his little lean-back seat at the eyepiece of the gigantic solaroscope, paused and looked downward.

Outside, Beta was a mere smoldering splinter, taking one last desperate look at Lagash. The eastern horizon, in the direction of the city, was lost in Darkness, and the road from Saro to the Observatory was a dull-red line bordered on both sides by wooded tracts, the trees of which had somehow lost individuality and

merged into a continuous shadowy mass.

But it was the highway itself that held attention, for along it there surged another, and infinitely menacing, shadowy mass.

Aton cried in a cracked voice, "The madmen from the city! They've come!"

"How long to totality?" demanded Sheerin.

"Fifteen minutes, but . . . but they'll be here in five."

"Never mind, keep the men working. We'll hold them off. This place is built like a fortress. Aton, keep an eye on our young Cultist just for luck. Theremon, come with me."

SHEERIN was out the door, and Theremon was at his heels. The stairs stretched below them in tight, circular sweeps about the central shaft, fading into a dank and dreary grayness.

The first momentum of their rush had carried them fifty feet down, so that the dim, flickering yellow from the open door of the dome had disappeared and both up above and down below the same dusky shadow crushed in upon them.

Sheerin paused, and his pudgy hand clutched at his chest. His eyes bulged and his voice was a dry cough. "I can't . . . breath . . . go down . . . yourself. Close all doors—"

Theremon took a few downward steps, then turned. "Wait! Can you hold out a minute?" He was panting himself. The air passed in and out his lungs like so much molasses, and there was a little germ of screeching panic in his mind at the thought of making his way into the mysterious Darkness below by himself.

Theremon, after all, was afraid of the dark!

"Stay here," he said. "I'll be back in a second." He dashed upward two steps at a time, heart pounding—not altogether from the exertion—tumbled into the dome and snatched a torch from its holder. It was foul smelling, and the smoke smarted his eyes almost blind, but he clutched that torch as if he wanted to kiss it for joy, and its flame streamed backward as he hurtled down the stairs again.

Sheerin opened his eyes and moaned as Theremon bent over him. Theremon shook him roughly. "All right, get a hold on yourself. We've got light."

He held the torch at tiptoe height and, propping the tottering psychologist by an elbow, made his way downward in the middle of the protecting circle of illumination.

The offices on the ground floor still possessed what light there was, and Theremon felt the horror about him relax.

"Here," he said brusquely, and passed the torch to Sheerin. "You can hear *them* outside."

And they could. Little scraps of hoarse, wordless shouts.

But Sheerin was right; the Observatory *was* built like a fortress. Erected in the last century, when the neo-Gavottian style of architecture was at its ugly height, it had been designed for stability and durability, rather than for beauty.

The windows were protected by the grillework of inch-thick iron bars sunk deep into the concrete sills. The walls were solid masonry that an earthquake couldn't have touched, and the main door was a huge oaken slab reinforced with iron at the strategic points. Theremon shot the bolts and they slid shut with a dull clang.

At the other end of the corridor, Sheerin cursed weakly. He pointed

to the lock of the back door which had been neatly jimmied into uselessness.

"That must be how Latimer got in," he said.

"Well, don't stand there," cried Theremon impatiently. "Help drag up the furniture—and keep that torch out of my eyes. The smoke's killing me."

He slammed the heavy table up against the door as he spoke, and in two minutes had built a barricade which made up for what it lacked in beauty and symmetry by the sheer inertia of its massiveness.

Somewhere, dimly, far off, they could hear the battering of naked fists upon the door; and the screams and yells from outside had a sort of half reality.

That mob had set off from Saro City with only two things in mind: the attainment of Cultist salvation by the destruction of the Observatory, and a maddening fear that all but paralyzed them. There was no time to think of ground cars, or of weapons, or of leadership, or even of organization. They made for the Observatory on foot and assaulted it with bare hands.

And now that they were there, the last flash of Beta, the last ruby-red drop of flame, flickered feebly over a humanity that had left only stark, universal fear!

Theremon groaned, "Let's get back to the dome!"

IN THE DOME, only Yimot, at the solaroscope, had kept his place. The rest were clustered about the cameras, and Beenay was giving his instructions in a hoarse, strained voice.

"Get it straight, all of you. I'm snapping Beta just before totality and changing the plate. That will leave one of you to each camera.

You all know about . . . about times of exposure—”

There was a breathless murmur of agreement.

Beenay passed a hand over his eyes. “Are the torches still burning? Never mind, I see them!” He was leaning hard against the back of a chair. “Now remember, don’t . . . don’t try to look for good shots. Don’t waste time trying to get t-two stars at a time in the scope field. One is enough. And . . . and if you feel yourself going, *get away from the camera.*”

At the door, Sheerin whispered to Theremon, “Take me to Aton. I don’t see him.”

The newsman did not answer immediately. The vague forms of the astronomers wavered and blurred, and the torches overhead had become only yellow spots.

“It’s dark,” he whimpered.

Sheerin held out his hand, “Aton.” He stumbled forward. “Aton!”

Theremon stepped after and seized his arm. “Wait, I’ll take you.” Somehow he made his way across the room. He closed his eyes against the Darkness and his mind against the chaos within it.

No one heard them or paid attention to them. Sheerin stumbled against the wall. “Aton!”

The psychologist felt shaking hands touching him, then withdrawing, and a voice muttering, “Is that you, Sheerin?”

“Aton!” He strove to breathe normally. “Don’t worry about the mob. The place will hold them off.”

LATIMER, the Cultist, rose to his feet, and his face twisted in desperation. His word was pledged, and to break it would mean placing his soul in mortal peril. Yet that word had been forced from him and had not been given freely. The Stars

would come soon; he could not stand by and allow— And yet his word was pledged.

Beenay’s face was dimly flushed as it looked upward at Beta’s last ray, and Latimer, seeing him bend over his camera, made his decision. His nails cut the flesh of his palms as he tensed himself.

He staggered crazily as he started his rush. There was nothing before him but shadows; the very floor beneath his feet lacked substance. And then someone was upon him and he went down with clutching fingers at his throat.

He doubled his knee and drove it hard into his assailant. “Let me up or I’ll kill you.”

Theremon cried out sharply and muttered through a blinding haze of pain, “You double-crossing rat!”

The newsman seemed conscious of everything at once. He heard Beenay croak, “I’ve got it. At your cameras, men!” and then there was the strange awareness that the last thread of sunlight had thinned out and snapped.

Simultaneously he heard one last choking gasp from Beenay, and a queer little cry from Sheerin, a hysterical giggle that cut off in a rasp—and a sudden silence, a strange, deadly silence from outside.

And Latimer had gone limp in his loosening grasp. Theremon peered into the Cultist’s eyes and saw the blankness of them, staring upward, mirroring the feeble yellow of the torches. He saw the bubble of froth upon Latimer’s lips and heard the low animal whimper in Latimer’s throat.

With the slow fascination of fear, he lifted himself on one arm and turned his eyes toward the blood-curdling blackness of the window.

Through it shone the Stars!

Not Earth’s feeble thirty-six hun-

dred Stars visible to the eye—Lagash was in the center of a giant cluster. Thirty thousand mighty suns shown down in a soul-searing splendor that was more frighteningly cold in its awful indifference than the bitter wind that shivered across the cold, horribly bleak world.

Theremon staggered to his feet, his throat constricting him to breathlessness, all the muscles of his body writhing in a tensivity of terror and sheer fear beyond bearing. He was going mad, and knew it, and somewhere deep inside a bit of sanity was screaming, struggling to fight off the hopeless flood of black terror. It was very horrible to go mad and know that you were going mad—to know that in a little minute you would be here physically and yet all the real essence would be dead and drowned in the black madness. For this was the Dark—the Dark and the Cold and the Doom. The bright walls of the universe were shattered and their awful black fragments were falling down to crush and squeeze and obliterate him.

He jostled someone crawling on hands and knees, but stumbled somehow over him. Hands groping at his tortured throat, he limped toward the flame of the torches that filled all his mad vision.

"Light!" he screamed.

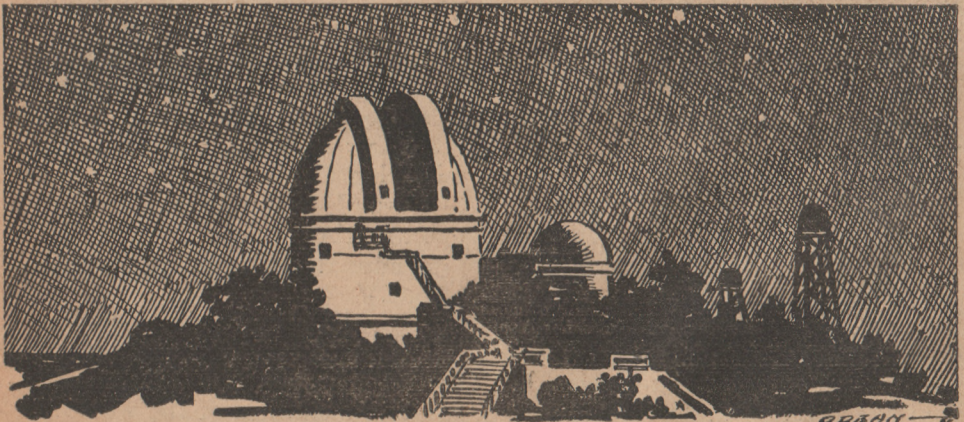
Aton, somewhere, was crying, whimpering horribly like a terribly frightened child. "Stars—all the Stars—we didn't know at all. We didn't know anything. We thought six stars is a universe is something the Stars didn't notice is Darkness forever and ever and ever and the walls are breaking in and we didn't know we couldn't know and anything—"

Someone clawed at the torch, and it fell and snuffed out. In the instant, the awful splendor of the indifferent Stars leaped nearer to them.

On the horizon outside the window, in the direction of Saro City, a crimson glow began growing, strengthening in brightness, that was not the glow of a sun.

The long night had come again.

THE END.





ADAM AND NO EVE

By Alfred Bester

*The last living man on a world rendered utterly lifeless
by all-consuming fire—how could he start life alone?*

Illustrated by Schneeman

CRANE knew this must be the sea-coast. Instinct told him; but more than instinct, the few shreds of
AST—3k

knowledge that clung to his torn, feverish brain told him; the stars that had shown at night through the

rare breaks in the clouds, and his compass that still pointed a trembling finger north. That was strangest of all, Crane thought. Though a welter of chaos, the Earth still retained its polarity.

It was no longer a coast; there was no longer any sea. Only the faint line of what had been a cliff, stretching north and south for endless miles. A line of gray ash. The same gray ash and cinders that lay behind him; the same gray ash that stretched before him. Fine silt, knee-deep, that swirled up at every motion and choked him. Cinders that scudded in dense mighty clouds when the mad winds blew. Cinders that were churned to viscous mud when the frequent rains fell.

The sky was jet overhead. The black clouds rode high and were pierced with shafts of sunlight that marched swiftly over the Earth. Where the light struck a cinder storm, it was filled with gusts of dancing, gleaming particles. Where it played through rain it brought the arches of rainbows into being. Rain fell; cinder-storms blew; light thrust down—together, alternately and continually in a jig saw of black and white violence. So it had been for months. So it was over every mile of the broad Earth.

Crane passed the edge of the ashen cliffs and began crawling down the even slope that had once been the ocean bed. He had been traveling so long that all sense of pain had left him. He braced elbows and dragged his body forward. Then he brought his right knee under him and reached forward with elbows again. Elbows, knee, elbows, knee— He had forgotten what it was to walk.

Life, he thought dazedly, is wonderful. It adapts itself to anything. If it must crawl, it crawls. Callous forms on the elbows and knees. The

neck and shoulders toughen. The nostrils learn to snort away the ashes before they inhale. The bad leg swells and festers. It numbs, and presently it will rot and fall off.

"I beg pardon," Crane said, "I didn't quite get that—"

He peered up at the tall figure before him and tried to understand the words. It was Hallmyer. He wore his stained lab jacket and his gray hair was awry. Hallmyer stood delicately on top of the ashes and Crane wondered why he could see the scudding cinder clouds through his body.

"How do you like your world, Stephen?" Hallmyer asked.

Crane shook his head miserably.

"Not very pretty, eh?" said Hallmyer. "Look around you. Dust, that's all; dust and ashes. Crawl, Stephen, crawl. You'll find nothing but dust and ashes—"

Hallmyer produced a goblet of water from nowhere. It was clear and cold. Crane could see the fine mist of dew on its surface and his mouth was suddenly coated with dry grit.

"Hallmyer!" he cried. He tried to get to his feet and reach for the water, but the jolt of pain in his right leg warned him. He crouched back.

Hallmyer sipped and then spat in his face. The water felt warm.

"Keep crawling," said Hallmyer bitterly. "Crawl round and round the face of the Earth. You'll find nothing but dust and ashes—" He emptied the goblet on the ground before Crane. "Keep crawling. How many miles? Figure it out for yourself. Pi-R-Square. The radius is eight thousand or so—"

He was gone, jacket and goblet. Crane realized that rain was falling again. He pressed his face into the warm sodden cinder mud, opened his mouth and tried to suck the mois-

ture. He groaned and presently began crawling.

There was an instinct that drove him on. He had to get somewhere. It was associated, he knew, with the sea—with the edge of the sea. At the shore of the sea something waited for him. Something that would help him understand all this. He had to get to the sea—that is, if there were a sea any more.

THE THUNDERING rain beat his back like heavy planks. Crane paused and yanked the knapsack around to his side where he probed in it with one hand. It contained exactly three things. A pistol, a bar of chocolate and a can of peaches. All that was left of two months' supplies. The chocolate was pulpy and spoiled. Crane knew he had best eat it before all value rotted away. But in another day he would lack the strength to open the can. He pulled it out and attacked it with the opener. By the time he had pierced and pried away a flap of tin, the rain had passed.

As he munched the fruit and sipped the juice, he watched the wall of rain marching before him down the slope of the ocean bed. Torrents of water were gushing through the mud. Small channels had already been cut—channels that would be new rivers some day. A day he would never see. A day that no living thing would ever see. As he flipped the empty can aside, Crane thought: The last living thing on Earth eats its last meal. Metabolism plays its last act.

Wind would follow the rain. In the endless weeks that he had been crawling, he had learned that. Wind would come in a few minutes and flog him with its clouds of cinders and ashes. He crawled forward,

bleary eyes searching the flat gray miles for cover.

Evelyn tapped his shoulder.

Crane knew it was she before he turned his head. She stood alongside, fresh and gay in her bright dress, but her lovely face was puckered with alarm.

"Stephen," she cried, "you've got to hurry!"

He could only admire the way her smooth honey hair waved to her shoulders.

"Oh darling!" she said, "you've been hurt!" Her quick gentle hands touched his legs and back. Crane nodded.

"Got it landing," he said. "I wasn't used to a parachute. I always thought you came down gently—like plumping onto a bed. But the gray earth came up at me like a fist— And UMBER was fighting around in my arms. I couldn't let him drop, could I?"

"Of course not, dear—" Evelyn said.

"So I just held on to him and tried to get my legs under me," Crane said. "And then something smashed my legs and side—"

He paused, wondering how much she knew of what really had happened. He didn't want to frighten her.

"Evelyn, darling—" he said, trying to reach up his arms.

"No dear," she said. She looked back in fright. "You've got to hurry. You've got to watch out behind!"

"The cinder storms?" He grimaced. "I've been through them before."

"Not the storms!" Evelyn cried. "Something else. Oh, Stephen—"

Then she was gone, but Crane knew she had spoken the truth. There was something behind—something that had been following him all those weeks. Far in the back of his

mind he had sensed the menace. It was closing in on him like a shroud. He shook his head. Somehow that was impossible. He was the last living thing on Earth. How could there be a menace?

The wind roared behind him, and an instant later came the heavy clouds of cinders and ashes. They lashed over him, biting his skin. With dimming eyes, he saw the way they coated the mud and covered it with a fine dry carpet. Crane drew his knees under him and covered his head with his arms. With the knapsack as a pillow, he prepared to wait out the storm. It would pass as quickly as the rain.

The storm whipped up a great bewilderment in his sick head. Like a child he pushed at the pieces of his memory, trying to fit them together. Why was Hallmyer so bitter toward him? It couldn't have been that argument, could it?

What argument?

Why, that one before all this happened.

Oh that!

Abruptly, the pieces fitted themselves together.

CRANE STOOD alongside the sleek lines of his ship and admired it tremendously. The roof of the shed had been removed and the nose of the ship hoisted so that it rested on a cradle pointed toward the sky. A workman was carefully burnishing the inner surfaces of the rocket jets.

The muffled sounds of an argument came from within the ship and then a heavy clanking. Crane ran up the short iron ladder to the port and thrust his head inside. A few feet beneath him, two men were buckling the long tanks of ferrous solution into place.

"Easy there," Crane called. "Want to knock the ship apart?"

One looked up and grinned. Crane knew what he was thinking. That the ship would tear itself apart. Everyone said that. Everyone except Evelyn. She had faith in him. Hallmyer never said it either. But Hallmyer thought he was crazy in another way. As he descended the ladder, Crane saw Hallmyer come into the shed, lab jacket flying.

"Speak of the devil!" Crane muttered.

Hallmyer began shouting as soon as he saw Crane. "Now listen—"

"Not all over again," Crane said.

Hallmyer dug a sheaf of papers out of his pocket and waved it under Crane's nose.

"I've been up half the night," he said, "working it through again. I tell you I'm right. I'm absolutely right—"

Crane looked at the tight-written equations and then at Hallmyer's bloodshot eyes. The man was half mad with fear.

"For the last time," Hallmyer went on. "You're using your new catalyst on iron solution. All right. I grant that it's a miraculous discovery. I give you credit for that."

Miraculous was hardly the word for it. Crane knew that without conceit, for he realized he'd only stumbled on it. You had to stumble on a catalyst that would induce atomic disintegration of iron and give 10×10^{10} foot-pounds of energy for every gram of fuel. No man was smart enough to think all that up by himself.

"You don't think I'll make it?" Crane asked.

"To the Moon? Around the Moon? Maybe. You've got a fifty-fifty chance." Hallmyer ran fingers through his lank hair. "But for God's sake, Stephen, I'm not worried about you. If you want to kill yourself, that's your own affair.

It's the Earth I'm worried about—"Nonsense. Go home and sleep it off."

"Look"—Hallmyer pointed to the sheets of paper with a shaky hand—"no matter how you work the feed and mixing system you can't get one hundred percent efficiency in the mixing and discharge."

"That's what makes it a fifty-fifty chance," Crane said. "So what's bothering you?"

"The catalyst that will escape through the rocket tubes. Do you realize what it'll do if a drop hits the Earth? It'll start a chain of iron disintegrations that'll envelope the globe. It'll reach out to every iron atom—and there's iron everywhere. There won't be any Earth left for you to return to—"

"Listen," Crane said wearily, "we've been through all this before."

He took Hallmyer to the base of the rocket cradle. Beneath the iron framework was a two-hundred-foot pit, fifty feet wide and lined with firebrick.

"That's for the initial discharge flames. If any of the catalyst goes through, it'll be trapped in this pit and taken care of by the secondary reactions. Satisfied now?"

"But while you're in flight," Hallmyer persisted, "you'll be endangering the Earth until you're beyond Roche's limit. Every drop of non-activated catalyst will eventually sink back to the ground and—"

"For the very last time," Crane said grimly, "the flame of the rocket discharge takes care of that. It will envelop any escaped particles and destroy them. Now get out. I've got work to do."

As he pushed him to the door, Hallmyer screamed and waved his arms. "I won't let you do it!" he repeated over and over. "I'll find

some way to stop you. I won't let you do it—"

WORK? No, it was sheer intoxication to labor over the ship. It had the fine beauty of a well-made thing. The beauty of polished armor, of a balanced swept-hilt rapier, of a pair of matched guns. There was no thought of danger and death in Crane's mind as he wiped his hands with waste after the last touches were finished.

She lay in the cradle ready to pierce the skies. Fifty feet of slender steel, the rivet heads gleaming like jewels. Thirty feet were given over to fuel the catalyst. Most of the forward compartment contained the spring hammock Crane had devised to take up the initial acceleration shock. The ship's nose was a solid mass of natural quartz that stared upward like a cyclopiian eye.

Crane thought: She'll die after this trip. She'll return to the Earth and smash in a blaze of fire and thunder, for there's no way yet of devising a safe landing for a rocket ship. But it's worth it. She'll have had her one great flight, and that's all any of us should want. One great beautiful flight into the unknown—

As he locked the workshop door, Crane heard Hallmyer shouting from the cottage across the fields. Through the evening gloom he could see him waving frantically. He trotted through the crisp stubble, breathing the sharp air deeply, grateful to be alive.

"It's Evelyn on the phone," Hallmyer said.

Crane stared at him. Hallmyer was acting peculiarly. He refused to meet his eyes.

"What's the idea?" Crane asked. "I thought we agreed that she wasn't to call—wasn't to get in touch with me

until I was ready to start? You been putting ideas into her head? Is this the way you're going to stop me?"

Hallmyer said: "No—" and studiously examined the indigo horizon.

Crane went into his study and picked up the phone.

"Now listen, darling," he said without preamble, "there's no sense getting alarmed now. I explained everything very carefully. Just before the ship crashes, I take to a parachute and float down as happy and gentle as Winken, Blinken and Nod. I love you very much and I'll see you Wednesday when I start. So long—"

"Good-by, sweetheart," Evelyn's clear voice said, "and is that what you called me for?"

"Called you!"

A brown hulk disengaged itself from the hearth rug and lifted itself to strong legs. Umber, Crane's Great Dane, sniffed and cocked an ear. Then he whined.

"Did you say I called you?" Crane shouted.

Umber's throat suddenly poured forth a bellow. He reached Crane in a single bound, looked up into his face and whined and roared all at once.

"Shut up, you monster!" Crane said. He pushed Umber away with his foot.

"Give Umber a kick for me," Evelyn laughed. "Yes, dear. Someone called and said you wanted to speak to me."

"They did, eh? Look, honey, I'll call you back—"

Crane hung up. He arose doubtfully and watched Umber's uneasy actions. Through the windows, the late evening glow sent flickering shadows of orange light. Umber gazed at the light, sniffed and belled again. Suddenly struck, Crane leaped to the window.

Across the fields a solid mass of flame thrust high into the air, and within it was the fast-crumbling walls of the workshop. Silhouetted against the blaze, the figures of half a dozen men darted and ran.

"Good heavens!" Crane cried.

He shot out of the cottage and with Umber hard at his heels, sprinted toward the shed. As he ran he could see the graceful nose of the spaceship within the core of heat, still looking cool and untouched. If only he could reach it before the flames softened its metal and started the rivets.

The workmen trotted up to him, grimy and panting. Crane gaped at them in a mixture of fury and bewilderment.

"Hallmyer!" he shouted. "Hallmyer!"

Hallmyer pushed through the crowd. His eyes were wild and gleamed with triumph.

"Too bad," he said. "I'm sorry. Stephen—"

"You swine!" Crane shouted. "You frightened old man!" He grasped Hallmyer by the lapels and shook him just once. Then he dropped him and started into the shed.

Hallmyer cried something and an instant later a body hurtled against Crane's calves and spilled him to the ground. He lurched to his feet, fists swinging. Umber was alongside, growling over the roar of the flames. Crane smashed a man in the face, and saw him stagger back against a second. He lifted a knee in a vicious drive that sent the last man crumpling to the ground. Then he ducked his head and plunged into the shop.

The scorch felt cool at first, but when he reached the ladder and began mounting to the port, he screamed with the agony of his burns. Umber was howling at the

foot of the ladder, and Crane realized that the dog could never escape from the rocket blasts. He reached down and hauled Umber into the ship.

Crane was reeling as he closed and locked the port. He retained consciousness barely long enough to settle himself in the spring hammock. Then instinct alone prompted his hands to reach out toward the control board. Instinct and the frenzied refusal to let his beautiful ship waste itself in the flames. He would fail—Yes. But he would fail, trying.

His fingers tripped the switches. The ship shuddered and roared. And blackness descended over him.

How LONG was he unconscious? There was no telling. Crane awoke with cold pressing against his face and body, and the sound of frightened yelps in his ears. Crane looked up and saw Umber tangled in the springs and straps of the hammock. His first impulse was to laugh; then suddenly he realized. He had looked *up!* He had looked up at the hammock.

He was lying curled in the cup of the quartz nose. The ship had risen high—perhaps almost to Roche's zone, to the limit of the Earth's gravitational attraction, but then without guiding hands at the controls to continue its flight, had turned and was dropping back toward Earth. Crane peered through the crystal and gasped.

Below him was the ball of the Earth. It looked three times the size of the Moon. And it was no longer his Earth. It was a globe of fire mottled with black clouds. At the northernmost pole there was a tiny patch of white, and even as Crane watched, it was suddenly blotted over with hazy tones of red,

scarlet and crimson. Hallmyer had been right.

He lay frozen in the cup of the nose for hours as the ship descended, watching the flames gradually fade away to leave nothing but the dense blanket of black around the Earth. He lay numb with horror, unable to understand—unable to reckon up a billion people snuffed out, a green fair planet reduced to ashes and cinders. His family, home, friends, everything that was once dear and close to him—gone. He could not think of Evelyn.

Air, whistling outside awoke some instinct in him. The few shreds of reason left told him to go down with his ship and forget everything in the thunder and destruction, but the instinct of life forced him to his feet. He climbed up to the store chest and prepared for the landing. Parachute, a small oxygen tank—a knapsack of supplies. Only half aware of what he was doing he dressed for the descent, buckled on the 'chute and opened the port. Umber whined pathetically, and he took the heavy dog in his arms and stepped out into space.

But space hadn't been so clogged, the way it was now. Then it had been difficult to breathe. But that was because the air had been rare—not filled with dry clogging grit like now.

Every breath was a lungful of ground glass—or ashes—or cinders—

The pieces of memory sagged apart. Abruptly he was in the present again—a dense black present that hugged him with soft weight and made him fight for breath. Crane struggled in mad panic, and then relaxed.

It had happened before. A long time past he'd been buried deep under ashes when he'd stopped to remember. Weeks ago—or days—or

months. Crane clawed with his hands, inching forward through the mound of cinders that the wind had thrown over him. Presently he emerged into the light again. The wind had died away. It was time to begin his crawl to the sea once more.

The vivid pictures of his memory scattered again before the grim vista that stretched out ahead. Crane scowled. He remembered too much, and too often. He had the vague hope that if he remembered hard enough, he might change one of the things he had done—just a very little thing—and then all this would become untrue. He thought: It might help if everyone remembered and wished at the same time—but there isn't any more everyone. I'm the only one. I'm the last memory on Earth. I'm the last life.

He crawled. Elbows, knee, elbows, knee— And then Hallmyer was crawling alongside and making a great game of it. He chortled and plunged in the cinders like a happy sea lion.

Crane said: "But why do we have to get to the sea?"

Hallmyer blew a spume of ashes.

"Ask her," he said, pointing to Crane's other side.

Evelyn was there, crawling seriously, intently; mimicking Crane's smallest action.

"It's because of our house," she said. "You remember our house, darling? High on the cliff. We were going to live there forever and ever, breathing the ozone and taking morning dips. I was there when you left. Now you're coming back to the house at the edge of the sea. Your beautiful flight is over, dear, and you're coming back to me. We'll live together, just we two, like Adam and Eve—"

Crane said: "That's nice."

Then Evelyn turned her head and screamed: "Oh, Stephen! Watch out!" and Crane felt the menace closing in on him again. Still crawling, he stared back at the vast gray plains of ash, and saw nothing. When he looked at Evelyn again he saw only his shadow, sharp and black. Presently, it, too, faded away as the marching shaft of sunlight passed.

But the dread remained. Evelyn had warned him twice, and she was always right. Crane stopped and turned, and settled himself to watch. If he was really being followed, he would see whatever it was, coming along his tracks.

THERE WAS a painful moment of lucidity. It cleaved through his fever and bewilderment, bringing with it the sharpness and strength of a knife.

I'm going mad, he thought. The corruption in my leg has spread to my brain. There is no Evelyn, no Hallmyer, no menace. In all this land there is no life but mine—and even ghosts and spirits of the underworld must have perished in the inferno that girdled the planet. No—there is nothing but me and my sickness. I'm dying—and when I perish, everything will perish. Only a mass of lifeless cinders will go on.

But there was a movement.

Instinct again. Crane dropped his head and played dead. Through slitted eyes he watched the ashen plains, wondering if death was playing tricks with his eyes. Another façade of rain was beating down toward him, and he hoped he could make sure before all vision was obliterated.

Yes. There.

A quarter mile back, a gray-brown shape was flitting along the gray surface. Despite the drone of the

distant rain, Crane could hear the whisper of trodden cinders and see the little clouds kicking up. Stealthily he groped for the revolver in the knapsack as his mind reached feebly for explanations and recoiled from fear.

The thing approached, and suddenly Crane squinted and understood. He recalled Umber kicking with fear and springing away from him when the 'chute landed them on the ashen face of the Earth.

"Why it's Umber," he murmured. He raised himself. The dog halted. "Here boy!" Crane croaked gayly. "Here boy!"

He was overcome with joy. He realized that a miserable loneliness had hung over him, almost a horrible sensation of oneness in emptiness. Now his was not the only life. There was another. A friendly life that could offer love and companionship. Hope kindled again.

"Here boy!" he repeated. "Come on, boy—"

After a while he stopped trying to snap his fingers. The Great Dane hung back, showing fangs and a lolling tongue. The dog was emaciated to a skeleton and its eyes gleamed red and ugly in the dusk. As Crane called once more, mechanically, the

dog snarled. Puffs of ash leaped beneath its nostrils.

He's hungry, Crane thought, that's all. He reached into the knapsack and at the gesture the dog snarled again. Crane withdrew the chocolate bar and laboriously peeled off the paper and silver foil. Weakly he tossed it toward Umber. It fell far short. After a minute of savage uncertainty, the dog advanced slowly and gobbled up the food. Ashes powdered its muzzle. It licked its chops ceaselessly and continued to advance on Crane.

Panic jerked within him. A voice persisted: This is no friend. He has no love or companionship for you. Love and companionship have vanished from the land along with life. Now there is nothing left but hunger.

"No—" Crane whispered. "That isn't right. We're the last of life on Earth. It isn't right that we should tear at each other and seek to devour—"

BUT UMBER was advancing with a slinking sidle, and his teeth showed sharp and white. And even as Crane stared at him, the dog snarled and lunged.

Crane thrust up an arm under the



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dog's muzzle, but the weight of the charge carried him backward. He cried out in agony as his broken, swollen leg was struck by the weight of the dog. With his free right hand he struck weakly, again and again, scarcely feeling the grind of teeth gnawing his left arm. Then something metallic was pressed under him and he realized he was lying on the revolver he had let fall.

He groped for it and prayed the cinders had not clogged its mechanism. As Umber let go his arm and tore at his throat, Crane brought the gun up and jabbed the muzzle blindly against the dog's body. He pulled and pulled the trigger until the roars died away and only empty clicks sounded. Umber shuddered in the ashes before him, his body nearly shot in two. Thick scarlet stained the gray.

Evelyn and Hallmyer looked down sadly at the broken animal. Evelyn was crying, and Hallmyer reached nervous fingers through his hair in the same old gesture.

"This is the finish, Stephen," he said. "You've killed part of yourself. Oh—you'll go on living, but not all of you. You'd best bury that corpse, Stephen. It's the corpse of your soul."

"I can't," Crane said. "The wind will blow the ashes away."

"Then burn it—"

It seemed that they helped him thrust the dead dog into his knapsack. They helped him take off his clothes and pack them underneath. They cupped their hands around the matches until the cloth caught fire, and blew on the weak flame until it sputtered and burned limply. Crane crouched by the fire and nursed it until nothing was left but more gray ash. Then he turned and once again began crawling down the

ocean bed. He was naked now. There was nothing left of what-had-been but his flickering little life.

He was too heavy with sorrow to notice the furious rain that slammed and buffeted him, or the searing pains that were shooting through his blackened leg and up his hip. He crawled. Elbows, knee, elbows, knee — Woodenly, mechanically, apathetic to everything. To the latticed skies, the dreary ashen plains and even the dull glint of water that lay far ahead.

He knew it was the sea—what was left of the old, or a new one in the making. But it would be an empty, lifeless sea that some day would lap against a dry lifeless shore. This would be a planet of rock and stone, of metal and snow and ice and water, but that would be all. No more life. He, alone, was useless. He was Adam, but there was no Eve.

Evelyn waved gayly to him from the shore. She was standing alongside the white cottage with the wind snapping her dress to show the clean, slender lines of her figure. And when he came a little closer, she ran out to him and helped him. She said nothing—only placed her hands under his shoulders and helped him lift the weight of his heavy pain-ridden body. And so at last he reached the sea.

IT WAS real. He understood that. For even after Evelyn and the cottage had vanished, he felt the cool waters bathe his face. Quietly—Calmly—

Here's the sea, Crane thought, and here am I. Adam and no Eve. It's hopeless.

He rolled a little farther into the waters. They laved his torn body. Quietly—Calmly—

He lay with face to the sky, peer-

ing at the high menacing heavens, and the bitterness within him welled up.

"It's not right!" he cried. "It's not right that all this should pass away. Life is too beautiful to perish at the mad act of one mad creature—"

Quietly the waters laved him. Quietly— Calmly—

The sea rocked him gently, and even the agony that was reaching up toward his heart was no more than a gloved hand. Suddenly the skies split apart—for the first time in all those months—and Crane stared up at the stars.

Then he knew. This was not the end of life. There could never be an end to life. Within his body, within the rotting tissues that were rocking gently in the sea was the source of ten million-million lives. Cells—tissues — bacteria — endamoeba— Countless infinities of life that would take new root in the waters and live long after he was gone.

They would live on his rotting remains. They would feed on each other. They would adapt themselves

to the new environment and feed on the minerals and sediments washed into this new sea. They would grow, burgeon, evolve. Life would reach out to the lands once more. It would begin again the same old repeated cycle that had begun perhaps with the rotting corpse of some last survivor of interstellar travel. It would happen over and over in the future ages.

And then he knew what had brought him back to the sea. There need be no Adam—no Eve. Only the sea, the great mother of life was needed. The sea had called him back to her depths that presently life might emerge once more, and he was content.

Quietly the waters rocked him. Quietly— Calmly—the mother of life rocked the last-born of the old cycle who would become the first-born of the new. And with glazing eyes Stephen Crane smiled up at the stars, stars that were sprinkled evenly across the sky. Stars that had not yet formed into the familiar constellations, nor would not for another hundred million centuries.

THE END.

ANALYTICAL LABORATORY

Two of the stories in the July Astounding took a definite and almost unanimously acclaimed lead. No story other than those two received *any* first-place votes; only six second-place votes went elsewhere. After those two places were fought out, though, the scattering was fairly complete. Final results were:

Place	Story	Author	Points
1.	Methuselah's Children	Robert Heinlein	1.15
2.	The Probable Man	Alfred Bester	2.7
3.	The Seesaw	A. E. van Vogt	3.55
4.	We Also Walk Dogs	Anson MacDonald	3.9
5.	Geometrics of Johnny Day	Nelson S. Bond	4.10

For which showing, Alfred Bester deserves commendation. His first Astounding novelette won second place against competition by Van Vogt and Anson MacDonald.

THE EDITOR.

THE SEA KING'S ARMORED DIVISION

By L. Sprague de Camp

An article in two parts, concerning the Age of Science that didn't quite come off—the Hellenistic Age. The boys were good back there; they had a lot of quite modern gadgets, from taxi meters to heavy armored tanks!

Illustrated by de Camp

RICHARD FARNSWORTH, intrepid explorer of time and space, stood beside Professor Glomp's desk and regarded the time machine with fearless calm. He stood, despite Glomp's invitation to sit, because he could not sit. He could not sit because his whipcord riding breeches were several sizes too tight. He wore tight riding breeches, for all their discomfort, because most intrepid explorers of time and space wear tight riding breeches. See the pictures on and in the science-fiction magazines.

Farnsworth sighed, and the expansion of his massive chest sent several shirt buttons with sharp reports against the far wall. "To think," he said in his deep, calm voice, "of uncovering the lost arts and mysterious sciences of the ancients! To go back to old Egypt, or Yucatan, or Atlantis—"

"Nonsense!" snapped Professor Glomp, hunting through his beard for his glasses. "Atlantis was invented by Plato of Athens around 375 B. C., and you learned most of the mysterious science of the Egyptians in high school, though you didn't know it at the time."

"What do you mean?"

"You learned to calculate the area of a triangle and the volume of a pyramid, didn't you?"

"Oh. Is *that* all there was to it?"

"Not quite, but it gives you the idea. It was mysterious then because the priesthood took care to make a mystery of it, lest common people should get the idea that they could survey their own fields without calling in a priest. I'm going to send you back to the *real* scientific age of antiquity."

"You mean Mu or Lemuria?"

"No!" Glomp's shout sent his glasses off his nose and into his tangle of whiskers again. "We'll chase imaginary scientific ages when we've found out all we want to know about the real one: the Hellenistic Age."

"Huh? Oh, you mean Greeks? Pericles and Socrates and those guys?"

"Not exactly. This age came long after Socrates and Pericles, and neither of those fellows contributed anything to science. While the Hellenistic scientists all spoke Greek, they included Egyptians and Babylonians and Phoenicians and God knows what. Specifically, I'm going to send you to Alexandria in the year 200 B. C., when the decline of Hellenistic science had begun after the first glorious century. Your main job will be to photostat all the books in the public library. As there were seven hundred thousand of them, this may take you some time—I don't like that look in your eye,

Farnsworth. "What crazy idea are you incubating now?"

"I was thinking," said the young hero, "that with my knowledge of mechanized warfare, I could become an emperor or something—"

"No! In the first place, if you changed history, what would become of us? We might go out like candles. In the second, you couldn't possibly build machine guns and airplanes with the materials and tools available at the time."

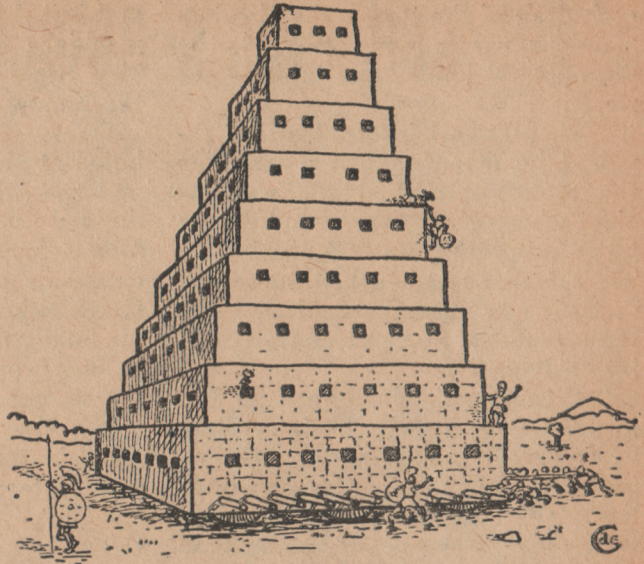
"I wouldn't have to," said Farnsworth. "I could rig up some sort of tank; a wagon covered with sheet iron—"

Glomp snorted. "You think that would be something new? They had mechanized warfare already. For instance: In 305 B. C. Demetrios Poliorketes attacked the city of Rhodes—"

"Who attacked what?"

"DEMETRIOS was the son of Antigonos One-eye, who was one of the Macedonian generals who carved up Alexander's empire after Alexander had drunk himself to death. Rhodes was an island city which was the commercial center of the eastern Mediterranean. Its government was a kind of aristocratic socialism. It had refused to join Antigonos in a war he had with Ptolemy, the Macedonian king of Egypt. So to punish it for its strict neutrality, Antigonos sent his son to teach the Rhodians a lesson.

"Demetrios Poliorketes was an en-



Reconstruction of the Helepolis of tank used by Demetrios Poliorketes at the Siege of Rhodes.

ergetic and resourceful fellow with no morals to speak of. He first attacked by sea, landing infantry in the harbor under cover of the fire of monitors. He protected the monitors by a boom with iron spikes. But the Rhodians were pretty resourceful men, too. They broke through the boom with their battleships, and burned or sank the monitors, and they drove Demetrios' soldiers off by furious counterattacks.

"Then Demetrios tried to take the city from the land side. He built an armored division headed by a tank of the latest and biggest model. He brought the tank up near the wall of the city and opened fire. The next night, the Rhodians hauled their best artillery to that part of the wall and bombarded the tank. They knocked off some of its iron armorplate, and shot incendiary bombs through the gaps.

"Demetrios had foreseen this; he had water tanks and fire buckets on

each deck of the tank, and with tremendous exertions his army put the fire out and hauled the tank out of range.

"When Demetrios got his tank repaired he attacked again. But as the tank approached the wall its eight wheels sank deeper and deeper into the ground, until it stuck fast. The Rhodians had turned the sewers of their city into the field that the tank would cross, and converted it into a bog.

"Of course, I'm being a little free in my terminology. Their artillery was catapults, the bigger ones throwing stones and the smaller ones javelins. The tank was a movable siege-tower fifty feet square at the base and a hundred feet high, with sheet-iron armor on its front and sides. The armor had loopholes with shutters for firing catapults through. The tank had nine stories or decks, connected by two sets of ladders, one for up traffic and one for down. The wheels were caster-mounted so the tank could maneuver, and the whole contraption was pushed by thirty-four hundred of Demetrios' strongest soldiers.

"Demetrios' monitors—I don't know what else to call them—each consisted of two ships fastened together, with a platform over both of them and a big catapult on the platform. He built one monitor of six ships, with a super-colossal catapult on the platform. But the Rhodians came out one night and burned this unit before it got into action." Glomp twinkled. "Now, young man, do you still think you'd like to lead a Hellenistic army or navy against men like those?"

"N-no, maybe not. What happened then?"

"You mean at Rhodes? Demetrios gave the siege up as a bad job, signed a treaty with the Rhodians,

and sailed away, leaving behind the machines of his armored division. The Rhodians sold these and used the money to build the Colossus of Rhodes. Antigonos One-eye was killed at the Battle of Ipsos in 301, and the other Macedonian generals divided up his Asia Minor kingdom. Demetrios had a long and violent career as a sea king, ruling a few Greek cities and an unbeatable navy. He finally died in jail."

Farnsworth asked: "If these people were so scientific and all, why didn't they start the Machine Age then instead of fourteen hundred years later?"

"That," said Glomp, "is one of the things you're going back to try to find out."

AND that is one of the things this article is about. For if ever there was a scientific age before the modern one—that is, the one that started in Europe with Copernicus and Galilei and is still in progress—if ever men showed all the symptoms of embarking on a Machine Age and then didn't, it was in the eastern Mediterranean between 300 and 100 B. C. The question of how and why Hellenistic science, after going up like a rocket, came down like a burned stick, merits attention from everyone who is interested in the might-have-beens of history, or in Science with a capital S.

First, the background: In the year 323 B. C. died Alexander the son of Philip of Macedon, after taking over by force of arms the entire Achaemenid or Persian Empire. This included, besides modern Iran, the modern Anatolia, Syria, Irak, Afghanistan and Egypt. His generals murdered the surviving members of his family and set themselves up as kings in various parts of his conquests. They and their descendants

then fought among themselves for three centuries until the Romans gobbled them up one by one.

In most history texts the wars of the *Diadochi* or Successors and their *Epigoni* or Descendants are passed over without much more detail than that. Politically speaking, these wars did not prove anything. They were conflicts of personalities and interests rather than of systems and ideas, as many of the previous Greek and Greco-Persian wars had been. And the last of the kingdoms of the *Diadochi* lost its independence in 47 B. C. when Julius Caesar expropriated—a polite way of saying he stole—Egypt for his personal property.

From a military point of view the wars of the *Diadochi* are very interesting—those boys tried everything. And for lurid melodrama, full of colossal treacheries, monstrous murders, and spectacular suicides, the period can be compared to none except France under the Merovingians.

For the benefit of those who like a little grue with their history, here are a few examples: (a) A governor of Crete learned that his master, King Ptolemy, planned to arrest him. He rushed home, killed all his family, persuaded his in-laws to do likewise and then kill themselves, set fire to his house, and finally killed himself in the burning house. (b) Alexander's sister, Cleopatra, decided to marry Ptolemy. On her way to Egypt she was detained at Sardis at the orders of Antigonos One-eye, who had wanted to marry her himself. The governor of Sardis, still obeying orders, had her killed by some women. Then Antigonos, to keep his part in the affair dark, had the women beheaded. (c) One of the Ptolemies fought a civil war with his wife, and he killed their son

for no reason except to make his wife feel badly.

So much for Hellenistic politics: It has plenty of names and dates; battles, flights and other dramatic incidents, but few well-marked trends. And without a few trends for the writer to make ponderous remarks about, an article like this remains a mere agglomeration of facts of doubtful interest. Let us hope that the story of Hellenistic science shows more obvious structural integration. But let us remember that the facts of history are so many and various that an industrious whitherer can, by proper selection, produce facts to prove that people were or are trending in any direction he wants them to trend.

The year after Alexander's death, his old tutor, Aristotle of Stagira, died. Aristotle, who raised the curtain on Hellenistic science, had been a pupil of Plato. Plato had been a pupil of Socrates, who had gone into philosophy during the Periclean antiscientific reaction at Athens, and who was strongly influenced thereby.

Greek thinkers before Socrates had composed wonderful theories about the nature of man and the universe. Some of these guesses were amazingly good: Demokritos had produced an atomic theory, a nebular hypothesis and an evolutionary theory complete with natural selection. But other guesses were wildly wrong. Few of the guessers resorted to experiment to check their theories. Even if they had, most of the guesses were too cosmic to be handled by the experimental techniques available. Socrates concluded that science was nothing but a lot of childish 'tis-'tain't argument. Plato, following Socrates, declared that one could learn all there was to know by pure introspection, and he produced the most monumental structure of

beautiful, meaningless verbiage the world had seen up to then.

ARISTOTLE was a prodigious worker with an encyclopedic mind. He was a bit more scientific—materialistic, if you prefer—than Plato, though he was sufficiently under his teacher's influence to indulge in such sublime bits of nonsense as this:

"To prove the immutability and incorruptibility of the heavens:

"1. Mutation is either generation or corruption.

"2. Generation and corruption only happen between contraries.

"3. The motions of contraries are contrary.

"4. The celestial motions are circular.

"5. Circular motions have no contraries. (Follows "proof" of this statement.)

"6. Therefore, celestial motions have no contraries.

"7. Therefore, among celestial things there are no contraries.

"8. Therefore, the heavens are eternal, immutable and incorruptible."

Aristotle's huge writings include a great mass of facts, assertions and inferences in numerous fields, including astronomy, meteorology, physics, zoology, physiology, anthropology, politics and even some essays—"On the Soul"—that might have served as a basis for psychology if anyone had cared to go on from where he left off. It is, of course, untrue that Aristotle knew everything there was to be known in his time; it is most unlikely that he knew how to build a boat or speak Etruscan. He did know a most astonishing lot, even when we allow for the fact that he knew a vast number of things that are not so.

His physiology is full of easily checked mistakes, and his physics is

almost entirely wrong. He did some experiments, but they seem to have led him only further astray. For instance, he weighed a bladder inflated with air, and weighed it again with the air let out, and concluded that air has no weight: a natural but unfortunate error. He rejected the idea that a feather would fall in a vacuum as fast as a stone on the ground that motion in a vacuum was inconceivable and therefore did not exist.

His main contributions of lasting value were in zoology, in which he accumulated a great many sound observations mixed in with some old-wives' tales about spontaneous generation of caterpillars, and in the development of deductive logic. That means the science of reasoning correctly from a general principle to a particular inference. ("No cat has eight tails; every cat has one more tail than no cat; therefore, every cat has nine tails." This syllogism seems to be wrong, but it will give you the idea.)

This was a great and lasting accomplishment. In fact, it was so great and lasting that it quite distracted people's minds from the need for developing the other fundamental part of the logical process, which is the getting of the general principles in the first place; in other words, *inductive* logic.

Aristotle had advised the thinker to marshal and examine all the facts he could, and then form his general principles. This was an improvement on Plato, who had pointedly ignored the facts. ("The true astronomer should have no need of the starry heavens") and dredged his principles out of his subconscious. It was, moreover, the method advocated by the early modern philosophers of science, notably Francis Bacon and René Descartes.

Neither Aristotle nor Bacon said

how the principles were to be derived from the facts. The thinker presumably used his intuition or inspiration. This method has resulted in many brilliant discoveries, but it led Aristotle into creating a lot of entirely spurious "natural laws" about generation's occurring only between contraries, et cetera. Inductive reasoning had to wait for J. S. Mill in the nineteenth century to give it a scientific formulation.

That is not to say that Aristotle's deductive logic is not perfectly good when used on problems that it is equipped to handle. The trouble was that for two thousand years people tried to use it to solve all the problems of the universe. This is like trying to use one branch of mathematics—plane trigonometry, say—to design an electric motor, calculate the temperature of a star, and compile General Motors' balance sheet. The result is shown by the sad case of Aristotle and the incorruptible heavens.

Aristotle founded a school, the Lycaean, in Athens, to compete with Plato's Academy. For about a century this school turned out a lot of scientific research. Unfortunately the records of most of this work are lost. Some scientific work was done at Antioch, and a lot at huge Syracuse in Sicily, where Archimedes was practically a one-man scientific revolution in himself.

DURING the two or three Hellenistic centuries Athens maintained a precarious independence—most of the time—by buttering the Epigoni and the neighboring Greek tyrants with all its might. The rest of the Hellenistic world looked upon Athens much as we regard Boston. Tourists came in droves to gawp at the monuments of "antiquity" and say: "My dear, don't you just adore

these quaint old narrow streets? So different from the vulgar modern towns like Seleucia, with their grid-iron plans—"

Clubs and fraternities flourished like rabbits throughout the Hellenistic world. People argued interminably about internationalism—invented by Zeno the Stoic—and pacifism. Writers like Iambulos wrote fantasies about islands in the Indian Ocean where the people lived under an ideal classless society, run on the principles of Stoic communism. The richer women took to wearing transparent silk dresses, and the poorer ones cut their hair short and sold it for catapult skeins.

One of the several cities named Alexandria which Alexander the Great had founded was the port and naval base in Egypt. When the Diadochi divided the realm, Egypt was taken by Ptolemaios Soter or Ptolemy the Savior, who made Alexandria his capital. Alexandria grew enormously and became *the* Hellenistic city, so that the Hellenistic thinkers and their period are often called the Alexandrine School and Age.

Ptolemy Soter founded the museum—really a university—and the library, which was expanded further by his successors, Ptolemy Philadelphus and Ptolemy Euergetes. These three Ptolemies were all intellectuals as well as statesmen; the first was a historian, the second dabbled in zoology, and the third was a mathematician. After them the line ran down, and the incompetent Ptolemies did more damage than the able ones could repair. They absorbed a lot of Egyptian culture, but they were still Macedonians. The last and one of the ablest of them, Cleopatra Philopator—*the* Cleopatra—was thought something of a wonder

because she was the first of the Ptolemies to learn Egyptian.

THE MOST spectacular achievements of Hellenistic science were in mathematics and astronomy. Let us take them up first. This will leave the ultimate failure of Hellenistic science to be considered in a later article. We shall find it convenient not to try to separate the two sciences, because most of the mathematicians were astronomers and vice versa.

Mathematics was nothing new; the Hellenistic mathematicians drew on the work of many illustrious Greek, Egyptian and Babylonian predecessors. The Alexandrines' system of numerals, and hence their arithmetic, was Greek. Their geometry came from Greece and Egypt. The Babylonian contribution was angular measurement, the basis of trigonometry.

The Babylonian concept of the degree ($^{\circ}$) grew out of the Babylonian system of numerals. This system had a base of 60, just as we have a base of 10 in ours. The Babylonians discovered that a circle can be divided into sixths by laying off a series of chords equal to the radius. From there it was an easy step to dividing the arc subtended by one of these chords into sixtieths, wherefore the entire circle would be divided into three hundred and sixty of these units.

The Babylonians, though they had no zero symbol, made limited use of place-value. This means that the value of a symbol depends on its position in a number. In our numerals, for instance, the symbol 2 in the right-hand column means 2, but in the next to the right-hand column it means 20. Hence any finite number can be expressed by the appropriate combination of the members of a

very small group of symbols.

Unfortunately the Babylonian symbols for the numerals up to and including 59 consisted of a series of cuneiform hen tracks of, for the larger numbers, horrible complexity. The Hellenistic world adopted the much more compact Greek numerals, which were easier to use in computations involving small finite numbers. But the Greek system had neither a zero symbol *nor* place-value. These lacks had curious results.

The Greek system used the letters of the Greek alphabet for the positive integers up to 999. To bring the alphabet up to the necessary twenty-seven letters the Greeks added three characters: the Phoenician letters *vau* (F) for 6, and *koph* (Q) for 90, plus a symbol called *sampi* for 900. *Sampi* was a letter *psi*—the one that looks like a pitchfork—upside down. They used the letters *alpha* to *theta* for the numerals 1 to 9; *iota* to *koph* for 10 to 90; and *rho* to *sampi* for 100 to 900. Eight was H (*eta*); 50 was N (*nu*); 58 was NH; 300 was T (*tau*); 350 was TN; 358 was TNH, *tau-nu-eta*.

For higher orders of numerals the same symbols were used over with diacritic marks. For instance, 25,691 was /K/EXQA. It can easily be seen that there was none of the free-and-easy multiplication and division by multiples of ten that we know, by moving a decimal point or adding zeros. Every such operation meant changing all the characters. It is not surprising that nobody invented a diacritic to indicate a member of the group .1, .2 to .9. So decimals were never achieved. And without a decimal system, there was no way to indicate a fraction except by the ratio of two whole numbers, e. g., 43/159. Hence irrational numbers such as repeating decimals could

not be expressed at all.

The result was that when the existence of irrationals *was* established by the pre-Hellenistic Greeks, all sorts of scandal and tribulation ensued. The ratio of the hypotenuse to one of the sides of an isosceles right triangle must exist; anybody can see the sides of the triangle, and they must have *some* ratio. On the other hand, the ratio can *not* exist because it cannot be written. Wonderful opportunity for the mystagogues! They made the most of it!

Some belief in number magic, lucky numbers, et cetera, is part of the heritage of almost any culture, and the eastern Mediterranean had its share of this type of folk-superstition. It appeared in an unusually virulent form in the brotherhood founded in southern Italy by Pythagoras of Samos in the sixth century B. C. Pythagoras himself was a real mathematician, despite his mystical aberrations; his successors were mostly pseudomathematicians who ascribed sex and symbolisms to numbers. They talked about perfect numbers, amicable numbers, sacred numbers, virile numbers, et cetera.

Number myths were easy to concoct for a people that used the Greek numerals, since these were written with the same characters that made up Greek words. Words could be turned into numbers and back again with the greatest of ease. The Pythagoreans gave the ancient racket of numerology a push that has carried it right down to the present. Witness a recent letter in the *New York Times* on the mystic ubiquity of 7.

ONE of the first of the Alexandrine giants was Euclid (Eukleides), who founded a school of mathematics in Alexandria during the reign of Ptolemy Soter—around 300 B. C.

Euclid's main work was his "Elements," which contains most of what is now called plane geometry. This book has the distinction of being probably the only textbook that was used, either in its original form or in translations, practically unchanged for two thousand years. In deprecation of Euclid it is sometimes remarked that (a) he by no means invented all his proofs himself, but drew largely on his predecessors; (b) many of his proofs have been shown to be faulty; (c) his axioms are not necessarily eternal truths, as has been shown by the development of consistent and useful non-Euclidian geometries. To these statements it may be answered: (a) So did they all; we no doubt give many ancient scientists credit for original discovery simply because all record of their predecessors has perished. (b and c) As in the case of Aristotle's logic, it was not Euclid's fault that his successors swallowed his work whole without trying to correct or extend it.

One of Euclid's sources was the work of Eudoxios of Cnidus, who discovered that the volumes of spheres vary as the cubes of their radii. Eudoxios also invented the celestial spheres: a series of concentric transparent shells, with the Earth at the center. The heavenly bodies were mounted in these spheres like the decorations on a highball glass. This brings us to astronomy. I warned you that we could not disentangle astronomy and mathematics.

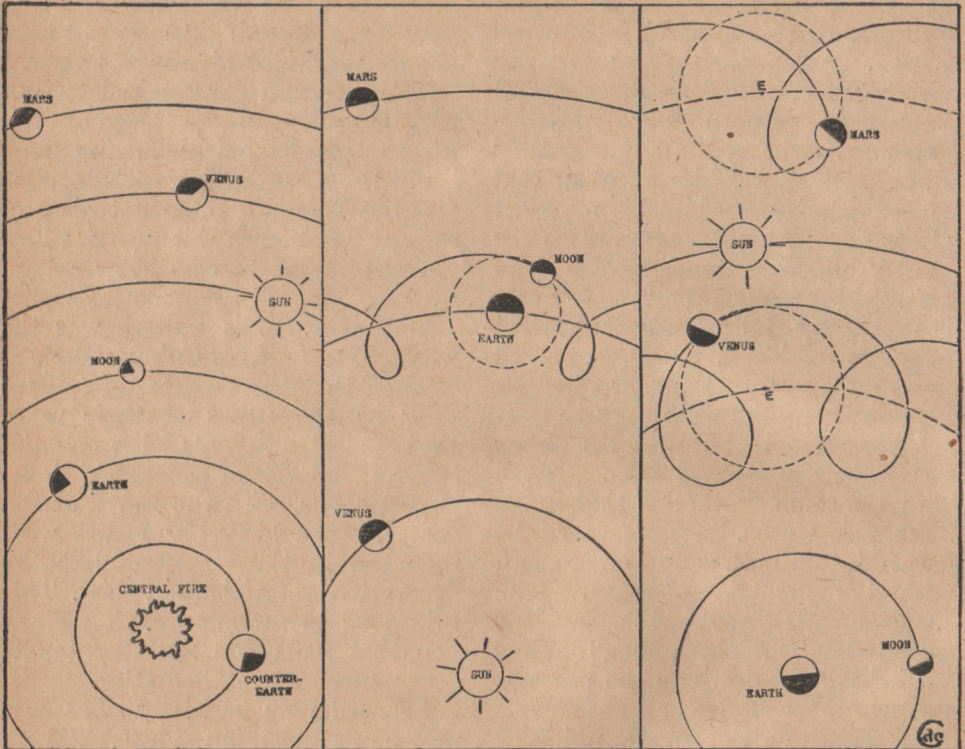
Learned men had long since outgrown flat-earthian ideas. There were two main schools of cosmogonic thought. The Babylonians held that the Earth was the center of the Universe, which was a hollow sphere on whose inside the heavenly bodies crawled around like flies. The Egyptians also thought that the Earth

was at the center of things, but they held that Mercury and Venus revolved around the Sun on its circuit, instead of around the celestial sphere.

The Babylonians introduced the notion of dividing the zodiac or equatorial belt into "houses" or sections, whereby the location of the Sun, Moon and planets could be described. This practice led to—or perhaps we should say merged with—the Babylonian system of celestial magic and mysticism called astrology. During the diffusion of ideas following the conquests of Al-

exander, astrology spread over the Hellenistic world; the Greeks and the Egyptians respectively took it over, renamed the "houses" to suit themselves—Aries, Taurus, et cetera—committed them to the care of their own gods and devils—such as the Egyptian Smat and Srat—and ascribed marvelous symbolic meanings to them.

OUR mystical friend Pythagoras—or perhaps his follower Philolaos—thought that perhaps the Earth did the moving. His cosmogony was otherwise wildly wrong. At the center



The Solar System according to (left) Pythagoras, (center) Aristarchos, (right) Apollonios. For simplicity only one inner and one outer planet are shown. In Apollonios' cosmogony Venus and Mars travel in circular paths called epicycles (broken line) around imaginary centers (marked "E") which traveled in circular paths around the Earth. The resultant paths of the planets relative to the Earth are shown by solid lines. In addition to these motions the whole system spun giddily around Earth once a day.

of the Universe was something called the Central Fire. The Earth revolved around this, always keeping one face toward it, the way the Moon always keeps one face toward the Earth. The side toward the Fire was at frying temperatures; we live on the far, inhabitable side. The Moon revolved around the Fire in an orbit outside that of the Earth. The Sun revolved outside the Moon's orbit, and was a mirror reflecting the light of the Fire. The planets revolved outside the Sun. Outside of everything was the good old celestial sphere containing the stars.

When Pythagoras—or Philolaos—added up the heavenly bodies, there were the Fire, Earth, Moon, Sun and five planets, making nine. There ought to be ten, because ten was the holiest of Pythagorean sacred numbers, being the fourth triangular number ($1+2+3+4+$). The Pythagoreans said prayers to it. To raise the number to ten, they invented an extra heavenly body, the counter-Earth, with an orbit inside that of the Earth and hence invisible from the inhabited side of the Earth. The counter-Earth helped to account for the frequency of lunar eclipses.

Kidinnu—or Kidenas—of Sippar in Babylonia had another idea, at variance with those held by his astrological countrymen. This was that the Sun was the center of the Universe; that the Earth revolved around it and also on its own axis; that the Earth was, in fact, a mere planet, or if you cared to look at it another way, the planets were worlds.

One Alexandrine giant either was converted to Kidinnu's theory or invented it independently: Aristarchos of Samos. Nicolaus Koppernigk referred to Aristarchos' theory in the original draft of his revolutionary "Revolutions of the Celestial Bod-

ies" (1543) but later deleted the passage, thereby getting his name affixed to the Copernican hypothesis. It would be almost as difficult now to get the name of the hypothesis changed to Kidinnan or Aristarchan as it would be to change America to Ericssonia.

The only savant known to have followed Aristarchos at that time was Seleukos of Seleucia-on-Tigris.* Cleanthes, the Stoic, said Aristarchos ought to be prosecuted for impiety, showing that it is unfair to accuse the Christian religion of being the only one to obstruct science. The only work by Aristarchos extant is "On the Sizes and Distances of the Sun and Moon." He gave the diameter of the Moon as one third that of the Earth, which is nearly right. His other results, though ingeniously and rigorously calculated, are far off because of errors in his assumptions.

He is credited with having invented the hemicyclic sundial—a hemispherical bowl with a rod projecting horizontally from one edge to the center. The disk-type sundial with a slanting gnomon is a medieval Arab invention that did not precede the wheeled clock by very many years.

THERE WERE two more giants of the generation of Aristarchos: Conon of Samos, who was court astronomer to the third Ptolemy, and Archimedes of Syracuse. Conon traveled for years in Italy making astronomical observations, and wrote seven volumes (lost) on astronomy.

Archimedes, whose father, Pheidias, had been an astronomer, studied at Alexandria and kept up a correspondence with Conon and Aris-

* That is one version. Authorities differ as to whether Kidinnu, Aristarchos, or Seleukos originated the heliocentric theory, and even as to the order in which they lived.

tarchos after he returned to Sicily. He did some calculations on astronomical distances, using Aristarchos' heliocentric hypothesis. But his main contributions were in the fields of solid geometry, statics and hydraulics. He discovered the ratio of the surface of a right circular cylinder to that of a sphere inscribed in it—try it if you think it's easy. He proposed a new system of numerals to handle large figures; not the equivalent of the modern Arabic, but more flexible than the existing one. In the course of this work he almost discovered logarithms. He calculated π to be between $3 \frac{1}{7}$ and $3 \frac{10}{71}$, which was the best up to then, and he almost discovered calculus. He established the laws for finding the center of gravity of plane figures. He set the whole science of hydrostatics firmly on its feet, as J. Willard Gibbs did with thermodynamics in the nineteenth century. He had no trouble with such concepts as specific gravity. (Aristotle had never been able to get the distinction between mass and density through his head, and so had talked a deal of nonsense about how fire rises because it is the nature of light things to rise.)

Archimedes discovered the law of the lever and invented a planetarium—not the Zeiss kind that give you a crick in the neck, but a model with balls representing the planets moved by turning a crank. He may have invented the compound pulley, and he certainly invented an assortment of catapults and cranes wherewith the Syracusans raised hob with the ships of General M. Claudius Marcellus when this formidable Roman attacked the city in the Second Punic War. In the final storming of Syracuse, Archimedes was killed by a Roman soldier, a fact that the partisans of science never forget to

point out to the admirers of the military.

Aristarchos, Conon and Archimedes had younger contemporaries who carried on the tradition of Alexandrine science after them: Eratosthenes of Cyrene and Apollonios of Perga. Eratosthenes was chief librarian at Alexandria. He wrote on mathematics and laid the foundation for mathematical geography. He achieved two really extraordinary feats: He measured the circumference of the Earth and got it correct to within one percent. His method was simple and ingenious. He read in one of the books in the library that at Syene, five thousand stadia south of Alexandria, the Sun shone to the bottom of a well on the day of the summer solstice. He waited till the next summer solstice came around and measured the angle made by the Sun at noon with a pillar in Alexandria. The angle turned out to be $7\frac{1}{2}^\circ$. This angle subtends an arc of about $\frac{1}{50}$ of a circle, so all he had to do was multiply the distance to Syene by fifty to get the Earth's circumference.

The other achievement, less immediately useful but even more spectacular, was his calculation of the distance to the Sun. The method he used is not known, but he hit it right on the nose with 804 million stadia. If we assume that he used the Athenian stadium of 607 English feet, that gives 92,400,000 miles, compared with the actual mean distance of 92,900,000.

Apollonios of Perga wrote an immense eight-volume treatise on conic sections, now mostly lost. He also invented the so-called Ptolemaic cosmogony, to account for the fact that the outer planets do not simply travel around the celestial sphere as the Moon does, but stop and backtrack a little when they reach the

part of the sky that is at the zenith at midnight. The Kidinnu-Aristarchos theory will account for this phenomenon by saying that the Earth passes these relatively slow-moving planets as it travels around its own orbit, so that naturally they seem to go backward.

Apollonios rejected the heliocentric theory. At least, he did not adopt it, and he was almost certainly familiar with it. He had a good reason. If the Earth moves around in a huge circle, the stars ought to exhibit parallax: their apparent direction should vary according to what part of the orbit the Earth occupies. But there was no parallax to be seen, so the Earth must stand still at the center of the celestial sphere. Apollonios had no way of knowing that the stars are so far away that Proxima Centauri, one of the nearest, displays a parallax of less than one second of arc, which can be detected only with a big telescope.

Apollonios' theory was that the planets went around the Earth in curves with loops pointing inward, making a sort of rosette. The loops accounted for the back-tracking.

These paths—now called epitrochoids—are formed by combining two circular motions: one—called the epicycle—of a planet around a point; the other of the point in question around the Earth. That is not too complicated. But as more accurate observations were made in subsequent centuries, it became necessary to add more and more motions to the supposed orbits of the planets. The system became so complex that when it was explained to King Alphonso X of Castile in the thirteenth century, the king remarked that if he had been present at the creation he could have given God some good advice. Alphonso's wisecrack almost got him excommunicated.

ABOUT THIS TIME another mathematician, named Diophantos, wrote a book which he called "Arithmetic," but which was actually the first recognizable algebra text. Diophantos devised a number of methods for solving certain equations of the first, second, third and fourth degrees. His methods were specific rather than general; general solutions had to wait for the Mohammedans of



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the Caliphate. But again it was a splendid beginning that was not followed up. Diophantos did not get to the point of using different symbols for different unknowns, nor did he conceive of negative quantities. Hellenistic mathematics was stymied by the tendency of the mathematicians to wander off into metaphysical arguments about the "reality" of their concepts. A negative number would have been a difficult idea for them to grasp, and an imaginary number probably impossible.

It was also handicapped by the baleful influence of Plato, which became stronger instead of weaker as the centuries rolled by. Plato had asserted that geometry was something to be practiced for the good of one's soul, and that the only gentlemanly instruments that might be used in geometrical construction were the compass and straightedge, somewhat as the medieval knight regarded the lance and the sword as the only gentlemanly weapons. Hence the fuss that was made over such problems as trisecting the angle with compass and straightedge only. It eventually transpired that the angle can be trisected, but *not* with the gentlemanly instruments alone. You need a special curve such as the quadratrix or the conchoid, both of which were known at that time.

These men were the cream of the Alexandrine crop. There were many worthy minor thinkers (see the table). After Apollonios, Eratosthenes and Diophantos, the Hellenistic world still produced giants, but more sparingly.

One of these was Hipparchos of Nicaea, who lived in the second century B. C. Any readers who suffered as I did over plane trigonometry can blame Hipparchos. Part of the time he lived at Rhodes, where he discovered the precession of the

equinoxes, unless our old friend Kidinnu of Sippar had beaten him to it. Later he came to Alexandria and invented trigonometry. He used the Babylonian system of dividing a circle into three hundred and sixty degrees. He calculated the first table of sines.

Hipparchos was probably a genius, but he was certainly a perfect bear for hard work. He prepared a great star catalogue giving the locations of more than a thousand stars, which is work by any standards. He also calculated the distance to the Moon and got an answer only five percent off.

He did not create trigonometry just for intellectual exercise; he applied it to cartography. It was his idea to rule off the Earth's surface in Babylonian degrees of latitude and longitude, so that any point can be located by two co-ordinates.

Latitudes can be determined in the Northern Hemisphere by measuring the angular distance of the pole star above the horizon—when there is a pole star. In Hellenistic times there was none; Polaris was several degrees off the polar axis. Astronomers had to aim at the center of the circle in which it revolved.

To determine the difference in longitude between two points, you have to take time into account. That means that you must have a portable clock that will keep its original time while you travel from point A to point B, or you must have some way of synchronizing your observations with somebody at the other point. Lacking both clocks and radio signals, the Alexandrines used eclipses of the Moon, on the justifiable assumption that they would be seen by observers at the two points simultaneously.

Hipparchos presumably wanted his trigonometrical system of Earth

THE HELLENISTIC SCIENTISTS

Name	Date of birth (approx.)	Fields	Specialties, discoveries, and inventions
Aristobolos of Cassandreia		History	History of Alexander's campaigns
Hieronimos of Cardia		History	History of the Successors
Theophrastos of Athens		Biology	Sex in plants
Eudemos of Rhodes		General science	History of mathematics and astronomy
Euclid of Alexandria		Mathematics	Plane and solid geometry
Herophilos of Chalcedon		Medicine	Anatomy
Eristratos of Chios		Medicine	Physiology, nerves, pæumatism
Pytheas of Phocæa		Geography and astronomy	Voyage to Britain (c. 300 BC), determination of latitude of Marseilles
Conon of Samos		Mathematics astronomy	Conic sections, solar eclipses
Aristarchos of Samos	310 BC	Astronomy	Copernican cosmogony, lunar and solar distances, hemicyclic sundial
Archimedes of Syracuse	287 BC	Mathematics, astronomy, physics and mechanics	Arithmetic, solid geometry, value of π , Archimedian spiral, lunar and solar distances, lever, hydrostatics, Archimedian screw, compound pulley, planetarium, catapults.
Zopyros of Tarentum		Mechanics	Crossbow
Eratosthenes of Cyrene	276 BC	Mathematics, astronomy, geography and history	Proportions, distance of the Sun, diameter of the Earth, mathematical geography, historical chronology
Apollonios of Perga	262 BC	Mathematics and astronomy	Conic sections, helix, value of π , Ptolemaic cosmogony
Aristophanes of Byzantium	257 BC	Linguistics	Lexicography and grammar
Diophantos of Alexandria		Mathematics	Algebra, Diophantine analysis
Nikomedes		Mathematics	Conchoid curve
Polybios of Megalopolis	201 BC	History	History of the rise of Rome
Hipparchos of Nicaea	160 BC	Mathematics, astronomy and geography	Trigonometry, star-catalogues, lunar eclipses, distance of the Moon, precession of the equinoxes, latitude and longitude
Diokles		Mathematics	Cissoid curve
Eudoxos of Cyzicus		Geography	Exploration of coasts of Africa
Kratenas		Biology	Description of herbs
Ktesibios of Alexandria		Mechanics	Water-clock, compressed-air catapult, steel-bow catapult
Heron of Alexandria		Mathematics, physics and mechanics	Areas and volumes of solids, reflection, surveying instrument, steam engine, slot machine, hydraulic organ, fire engine pump, self-trimming lamp, steam-operated automata, et cetera
Perseos		Mathematics	Spiric lines
Theodosios of Bithynia		Mathematics astronomy	Spherical trigonometry, sundial
Menelaos of Alexandria		Mathematics	Spherical Trigonometry
Dionysios of Thrace		Linguistics	Accidence and phonetics

The above is a list, in approximate order of dates of birth, of most of the Hellenistic scientists of whom record survives. Aristotle and Claudius Ptolemæus are omitted as being respectively before and after the Hellenistic period. The geographical epithets, "of Cassandreia" et cetera, are necessary because the Greeks of that period had no surnames.

measurement put into use as soon as possible, so that accurate maps could be drawn. To this end he prepared a table of lunar eclipses—another tremendous task—in the hope that one of the Hellenistic kings would finance a great survey that should accurately determine the latitude and longitude of many points in the known world. The survey was never carried out. But still, after Hipparchos' work, the outlines of countries on maps began to look recognizably like the outlines of the corresponding countries on the Earth, instead of the amoeboid doodles that had appeared on earlier maps.

THE NEXT IMPORTANT Alexandrine astronomer whose work has come down was Ptolemy (Claudius Ptolemaeus; no relation to the royal Ptolemies) in the second century A. D. Ptolemy, while technically an Alexandrine, was not a Hellenistic scientist; he belonged to the Roman period. With the Roman conquest of the East and the peculiar social-intellectual complex that grew up, the Alexandrine giants disappeared. Thereafter there was less scientific work, and what there was was scattered about the Mediterranean with its center at Rome rather than Alexandria.

The Romans made some contributions to civilization, but not in pure science. Characteristic Roman inventions were concrete for building and the import duty, the last having originated as a piece of emergency taxation during the Second Punic War.

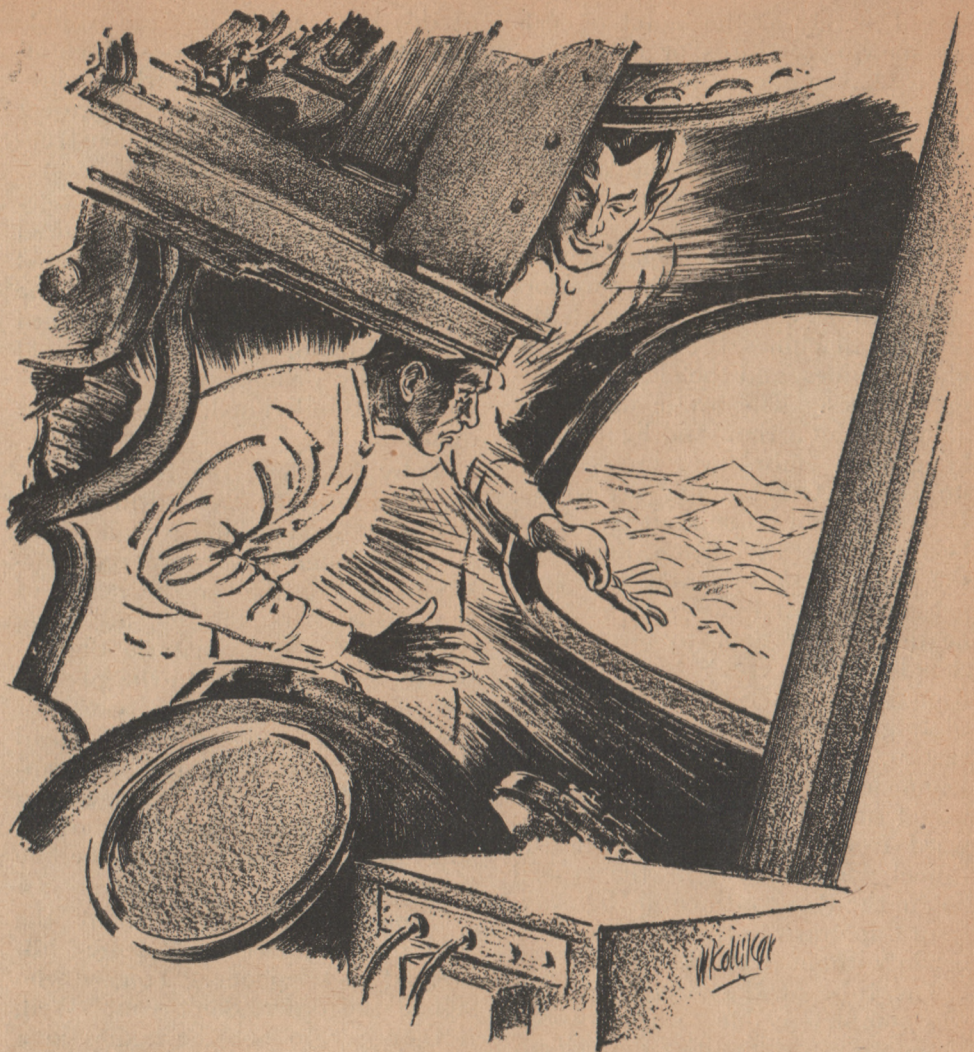
The influence of the Alexandrine giants did not die out overnight. Ptolemy, who left voluminous works on mathematics, astronomy and geography, drew largely on Hipparchos

—whom he greatly admired—in his monumental exposition of plane and spherical trigonometry. Like Aristotle, Ptolemy was an encyclopedic compiler of his predecessors' work rather than an original researcher. He did do original work on refraction. He propounded Apollonios' epicyclic cosmogony so impressively that it became known as the Ptolemaic system. His geography was thrown out of kilter by his adoption of the Earth measurements of Poseidonios, who had reduced Eratosthenes' uncannily correct figures by about a third. This explains why Columbus, who was familiar with Ptolemy's work, thought he had reached Asia when he discovered America.

In later Roman times Alexandria became a center of Neoplatonism. This was a philosophical school devoted to the spinning of cosmic cobwebs of Platonic mystical verbalism about the good, the true and the beautiful. By and large the Neoplatonists were no more scientific than the Christians with whom they became embroiled.

One of the last heads of the local school, Theon, did discover some things about square roots. Theon's daughter, Hypatia, ran the school after Theon, until she was set upon by a Christian mob instigated by Cyril, the Christian patriarch, and most piously torn into little bits with oyster shells (415 A. D.).

So much for mathematics and astronomy. Next month we shall survey the other branches of Hellenistic learning. Then comes the fun: the speculation as to why the Alexandrines failed, what a Richard Farnsworth would have to do to keep them from failing, and what might have happened if he had.



SHORT-CIRCUITED PROBABILITY

By Norman L. Knight

This is a yarn of something that did—or didn't—happen. Question is, can it be properly said either that it did or did not?

Illustrated by Kolliker

Nor quite midway of Bering Strait, and somewhat nearer to the Alaskan than to the Siberian shore, lies the islet called Big Diomedede.

Since the subsidence of the prehistoric land bridge this desolate dome of granite had withstood the battering of the arctic ice floes and had

served merely as the haunt of seals and mewling sea birds, or as the temporary haven of occasional fishermen or traders. But now the forces of an emergent world community had laid hold upon it and had made it the focal point of an immense and audacious project.

The interior of Big Diomède had been honeycombed with corridors and chambers; it vibrated with the drone of machines, the tinkle of telephone chimes, and the clamor of human voices. The arctic night was animated by a thousand lights sparkling from embrasures in its granite flanks. Great shafts pierced Big Diomède from its summit to a level below the ocean bottom, and from the bases of those shafts huge tunnel shields bored east and west beneath the sea floor to meet other shields which crept toward them from Alaska and Siberia. Squat ventilating towers, massive as medieval castles, sat upon the crest of Big Diomède; through them gales of air would rush downward into, and upward from, the twin tubes of the tunnel which would be the crucial link in the Pan-continental Highway, from Capetown to the Straits of Magellan without a break.

The tube of the electric railway was completed; due to a succession of unforeseen difficulties the vehicular tube was still unfinished. At the time of which we write Shield No. 2, crawling westward to meet the Siberian shield, had not moved an inch in twenty-four hours. The excavators in No. 2 had uncovered certain extremely perplexing objects, and all other work had been halted while the scientific staff supervised their removal.

This cessation of operations had interfered with the flow of materials through the railway tube, from the supply base at Nome. And because

of this interruption another trouble had been added unto those which already harassed one Mark Livingstone, in charge of a minor project on the island—to wit, the construction of a submarine dock.

Since repeated appeals by telephone had not secured the desired results, the engineer had descended in person upon the anteroom of the sanctum in Big Diomède occupied by the director of tunnel traffic and was loudly demanding an audience with that individual. He was not alone.

Toby Flanders, the traffic director then on duty, worked in a little box of a room behind a wall of lucite. Through this transparent partition he looked over the heads of the dispatchers in the adjoining chamber at a huge map on the opposite wall; it displayed the plan of the tunnel and the rail networks of the terminal yards at Tunnel Head and Nome in Alaska, and at Berinograd in Russia. The passage of a train was indicated by a red glow in successive shore segments of the line traversed.

"You needn't worry about the sanitary regulations," Toby addressed his telephone. "You see who signed the order, don't you? Well, if they say to put the bodies in a cooler-car, then that's what we do. So get going; we're waiting for it. Sure, it's cold enough here, but they're being shipped to Chicago and it's above freezing there. It has to be a cooler. The Field Museum wants to defrost them slowly."

The connection was broken and another call came in from the anteroom.

"Mark Livingstone! That pest?" exclaimed Toby. "Is he on the wire again? Tell him that normal traffic was resumed an hour ago but that

he'll have to wait his turn. Oh, he's out there now, is he?"

"Now he's in here!" announced the engineer, entering suddenly. A babel of protesting voices from the anteroom was cut short as he closed the door.

"Mr. Livingstone, I presume," observed the traffic director coldly.

"Purely negative humor," declared Mark. "Just because a man named Livingstone lost himself in Africa two hundred odd years ago, everyone who bears the name must endure that mildewed gag at least once a week. But here's what I want. I'm waiting for a trainload of vitrolith. It's shunted off on a siding in the yards at Tunnel Head. I went over and found it. I can do with five cars until you can bring me the rest. Just give me an order to the yard super at Tunnel Head so I can have them coupled on a prior train. I'll go over and take care of it myself."

"You're a persistent lug," Toby remarked. "Come back in half an hour; I'll see that you get your authorization. It will be at the desk outside, so don't come busting in here again."

On his way out, Mark paused at the desk in the anteroom and spoke to the youth who presided there.

"Tell me, what was it that delayed No. 2?" he inquired. "I've been told that it ran into a buried glacier and that there were some sort of creatures embedded in the ice. What are they?"

"They're in the morgue," Mark was informed. "While you're waiting you might go down and see for yourself."

A quick descent by elevator, then a short corridor, brought the engineer to the morgue entrance. The attendant who met him started to speak, then stuttered, gaped, stared

at him wide-eyed, and paled.

"What's wrong?" demanded Livingstone. "You look sick."

"Never mind. You'll find out," replied the attendant. "Some people from the Field Museum are in there; they'll explain things to you. I'd advise putting on these heated coveralls if you intend to stay in for any length of time. We're holding the room at zero flat."

STILL WONDERING, Livingstone was ushered into a bleak, blue-white chamber. Its walls were lined with the covers of air-tight crypts where the bodies of accidental victims of tunnel construction hazards were held pending shipment. In the center of the room the museum delegation, muffled in heavy clothing, clustered about two rectangular blocks of ice reposing on rubber-tired carriages. A photoflash bulb flared as the engineer approached one of these objects.

Mark introduced himself to a member of the delegation and learned the latter's name was Wentworth. Then he peered into the first block of ice and uttered a startled oath.

"It's human!" he ejaculated. "I expected something on the Neanderthal order, a hairy thing with a flat nose. But this looks modern—or does it?"

Suspended in the ice was the body of a man, approximately seven feet tall, muscled like a gladiator but symmetrically formed, clad in a close-fitting garment of violet with an intricate patterning of gold. The disquieting disposition of the limbs suggested broken bones. The hands were tapering, almost feminine, and lacked fingernails; this deficiency seemed not to be a mutilation since no evidence of scars was discernible. A sturdy neck supported the spheri-

cal head, whose hair-covered area was reduced to the semblance of a glossy brown cap forming an acute angle above the center of the forehead. The ears were somewhat pointed; one lay flat against the skull, the other was cocked outward alertly. The eyes were disproportionately large, surmounted by slender eyebrows with an elfin upward slant at the outer tips. The skin was a golden brown suffused by a glowing orange tint. The features were serene and contemplative, as if their owner had accepted death with composure.

"If it is a man, it revolutionizes all our ideas as to the age of the human race," asserted Wentworth. "There is no doubt that it was contemporary with the ice; there was no sign of later penetration from above. And the ice was originally a glacier, formed when an isthmus existed between Asia and America. It seems that the glacier partly melted, was covered by a landslide, and then was buried under an additional layer of sea bottom ooze after the isthmus subsided. And now we come along and bore into it with a tunnel, and find—"

He stopped, seized Livingstone's shoulder, scrutinized his face under the shadow of the coverall hood.

"I believe that you said your name is Livingstone. Would you mind throwing back that hood for a moment?" requested Wentworth in a strained voice.

Livingstone complied in silent surprise.

"Look at this!" commanded Wentworth loudly.

The entire company turned and looked at Livingstone. All conversation ceased with the abruptness of a radio turned off.

"What goes on here? Am I Dracula or something?" complained

Mark. "Plenty of people have seen me before and didn't become goggle-eyed in consequence."

Wentworth motioned speechlessly toward the second block of ice. Livingstone turned, regarded that which lay within it, and recoiled.

"Why, that's me!" he cried. "Even his clothes are the same! And that signet ring—it's the same!"

"That isn't all," declared Wentworth hollowly. "We found something else in the ice near him. I want you to see it. Just step this way."

THE entire company crowded into the receiving room of the morgue and divested themselves of their coveralls. At Wentworth's request the attendant opened a safe and brought forth a locked box, which Wentworth unlocked and extracted therefrom a gold-plated cigarette case.

"It's inscribed," remarked Wentworth, as he handed it to Livingstone. "Read it."

The engineer silently examined the case, laid it on the attendant's desk, and as silently reached into a pocket and produced its exact twin, which he laid beside it. Both were engraved with these words:

*Presented in Appreciation of Past Services
by
The Universal Brotherhood of Submarine
Structural Engineers
to*

Mark Livingstone, July 1, 2097

Moved by a sudden thought, Mark opened the two cases. His own contained seven cigarettes, the other, five—of identical brand.

"I'm paralyzed," confessed Mark at last. "What do you make of it?"

"Only this," replied Wentworth. "Either during or before the last glacial epoch a species of anthropoids

had already become like modern men, and one of them was your double. They reached our level, perhaps surpassed it. Then they vanished."

"But, confound it! That's stretching coincidence 'way beyond the breaking point! How could I have had a physical double with my name, and my profession, who smoked the same brand of cigarettes and wore the same kind of clothing? And there must have been another Julius Caesar in the past of the other race; how could they have had a month of July otherwise?"

"The name may have had a different derivation. Either we must accept the theory of historical repetition and coincidence on a grand scale, or admit that your corporeal self is in two places at the same time. Take your choice."

"I can't. That's the trouble. What about the other fellow—the man with the long hands and the orange-brown-colored skin? Where does he fit in?"

"Perhaps another early human variety—which didn't repeat."

"Did you find anything in addition to this cigarette case?"

"Yes, but it is not very informative." Wentworth turned to the attendant. "Please bring us the other article."

The other article was a smooth, black, ten-inch cube.

"To be consistent, I suppose that I should pull a duplicate of this from my pocket, but I can't," remarked Livingstone, as he hefted the cube experimentally. "I have never seen anything like it. It's very light."

"Also very hard," commented Wentworth. "A diamond won't scratch it."

"Do you suppose it's hollow?" pondered Livingstone, shaking the cube and then pressing it between

his hands. "It feels absolutely inflexible. Hello! What have I done?"

He hastily set down the cube. It was no longer black, but transparent, like a cube of glass. Within it was a mirror-surfaced sphere tangent to the six faces of the cube. Livingstone felt that it was whirling at terrific speed although there was no mark upon it to indicate the motion. It stimulated a sympathetic whirling in his own brain. Then it flashed, unbearably brilliant—or was it a flash of mental illumination?—and the cube became again black and opaque.

But that flash had wrought a strange effect upon those who had beheld it. In the fraction of a second it had projected into their minds a complete and ordered narrative which was also an explanation, a cry of distress, and an appeal for assistance—an appeal to minds other than those present, to minds which did not then exist, to minds of more than contemporary human scope and power.

It was an appeal from one who had attempted, in an extremity of peril, to summon certain of his fellows. He had assumed as a matter of course that those others would comprehend his meaning instantaneously and entire. But Livingstone and those with him, having merely normal mental capacities, could assimilate it only as a sequence, item by item; and that which had been hurled into their minds in the twinkling of an eye unfolded itself only as rapidly as their quickness of understanding would permit. Similarly, because of the limitations of the written word, the narrative which was transmitted in a instant must be set forth here at some length.

So for a time we shall consider certain things which befell that

Mark Livingstone who plunged to his death in a prehistoric glacial crevasse; whom the ice slowly engulfed; and who lay entombed there for three hundred thousand years.

Essentially, the account ran thus:

THE PLATFORM of the tunnel station under Big Diomedé was deserted when Mark emerged upon it. He had missed the train for Tunnel Head by thirty seconds.

(What's this? A previous tunnel? Why haven't we dug into its remains somewhere? And if Bering Strait was an isthmus then, why dig a tunnel?)

But there would be another train in fifteen minutes. The engineer withdrew a slip of blue paper from the breast pocket of his jacket, examined it with a smile of satisfaction, and replaced it. Hello! A train—no, a single coach—had drawn up at the platform. It had arrived as silently as a ghost. An odd type. It was windowless save for the motorman's cab in the nose, and that was dark. A short distance behind the cab a hairline crack outlined the rectangle of a door in the convex wall of the coach.

The door retreated inward with a soft hissing, slid aside, and revealed a dark interior. A single passenger came forth, garbed as a tunnel worker. The coach was headed in the right direction and the next stop necessarily would be Tunnel Head. Habitually an individual of quick decisions, Mark had entered as soon as the passenger had stepped aside. The door sank hissing into its frame behind him with an unaccustomed sound of solidity and finality, like the door of a safety deposit vault.

Hang it! Why was the vestibule unlighted? More than ever like a vault. Mark fumbled over the wall, feeling for the door to the interior of

the coach—half fell through the door which opened before him.

This was no ordinary passenger coach! It surpassed the cabin of a luxurious private air cruiser. This spangled ceiling, like a fabric of interwoven giant snow crystals! These shimmering cushioned benches along the walls, that table of blue lucite! Was that a telescreen built into the rear wall? And where were the lights? Perfect diffusion, apparently, from an invisible source. But, no! Everything in the cabin was radiating a gentle luminosity—even his own clothing, his own hands!

Mark was seized by an unaccountable feeling of smallness. He felt dwarfed. Then he understood. All the furnishings were definitely over-size.

And why was the coach not moving? There had been no jerk of acceleration. Seemingly the conveyance was standing silent and motionless. There was a dark passage entry alongside the door from the vestibule; presumably it gave access to the driver's compartment. But where was the driver? Was he the lone passenger who had alighted?

The driver's whereabouts were established by his appearance in the passage entry—a seven-foot giant, clad in a close-fitting violet garment, intricately brocaded with gold. His abnormally large and penetrating eyes expressed a mild surprise. Mark stared in unconcealed wonder at his tawny orange-brown skin, at his fingers without nails, at his bluntly pointed ears which swung forward and cupped themselves like the ears of an inquisitive dog.

"What do you call yourself?" inquired this apparition. "Were you instructed to join me at minus fifty-two one eleven? I was not told to expect you. What is your destination?"

"I'm Mark Livingstone," responded that individual. "It's rather important that I go to Tunnel Head. If I've invaded a private car, I'll get off. And if you don't mind telling—who are you?"

"I am called Haleyon. I would prefer not to violate my schedule by returning to Tunnel Head. We have left the tunnel and are suspended at an altitude of one thousand metros. Already we have overpassed the founding of Tunnel Head by thirty years negative."

"We've *what?*"

"Evidently you are not here by intention. If I may have your permission to scan your outer mind—I shall not probe into your private thoughts. Ah. It seems that explanations are in order. Let us be seated."

"But—shouldn't you go back to your cab?"

"I assure you that I need not change the controls until we arrive."

THE TWO seated themselves on opposite sides of the table of luminous blue crystal.

"It was a natural error for you to assume that this was one of the carriages used in your tunnel system," began Haleyon. "If you had looked underneath the vehicle you would have seen that it was not resting on wheels. It is known to us as a free-motion transport, since it can traverse both space and time, under water or through the air. I may make myself clearer if I call it a time-machine."

"But that's impossible!" Mark expostulated.

"Many things infinitely more simple have been called impossible. Actually it represents nothing more mysterious than any other kind of machine—always with the reservation that in the last analysis every-

thing is mysterious. It has its limitations, it requires a source of motive power, it conforms to the laws of mechanics—but naturally a kind of mechanics which is largely unfamiliar to you. We produce the smaller models by mass-production methods, in such numbers that it has been necessary to establish lanes of travel and regulations governing traffic."

"I may as well talk as if this were really happening," decided Livingstone. "In fact, I probably fell down the escalator in the tunnel station, hit my head, and this is my delirium. So tell me—who are 'we'? Who are you?"

"It well may be that I am one of your descendants. Our prime point of reference in time is the date of launching of the first successful free-motion transport, about fifty thousand years in the future relative to your age. Relative to that point, my native time is ten thousand plus, in round numbers."

"But this horde of time-machines that you mention: Doesn't it complicate things tremendously? And why isn't the past—your past, my present, my past—overrun with them?"

"It is an invention which has made life much more complex, but human beings can adapt themselves to the effects of anything which they can invent. And we have explored the nearer portions of our past very extensively, far beyond historic times as known to your generation. The remoter portions require careful preparation and some hardship to attain."

"Then, confound it! Why haven't we seen some of these travelers?"

"Probably you have. We have operatives working as observers in your tunnel project; they are active all over your world, all through your

past. I let one off when you got on. Our archæological information is obtained first-hand."

Livingstone eyed Halcyon skeptically.

"I could spot you in a crowd at a hundred yards," he remarked. "How do you disguise yourselves?"

"Sometimes by hypnotic deception, but that is fatiguing—particularly in large crowds. In more sophisticated eras, such as yours, it is easier to work through carefully instructed congenial contemporaries whom we approach discreetly. Our own physical and mental differences, indiscriminately revealed, usually aroused suspicion and hostility. Prior to the invention of the free-motion transport, our agents cannot openly declare themselves. If one does, he will find himself regarded as a charlatan, locked up in some disagreeable place of confinement, executed as a sorcerer, or subject to various other unpleasant kinds of treatment. If he is cautious, he will go down in history as a genius or a prophet of the first magnitude. In earlier and less skeptical times we need no intermediaries, but can appear frankly and be received as deities."

"But, surely— If you should set down one of your transports in a city street, or if you approached the wise men of the times—"

Halcyon responded with the patient air of one instructing a child.

"I, personally, am acquainted with a contemporary agent who made such an attempt in the century following yours. He was taken into custody for obstructing the thoroughfare and for lack of proper identification. He obtained an audience with the wise men only after prolonged efforts, by negotiation from his place of detention where he was under observation as a mental case.

The wise men came, and his efforts to explain the nature of the transport were meaningless to them, since no comprehensible terms then existed for describing it. We discovered his plight quite accidentally, and retrieved both the agent and the transport. Because of such difficulties, the arrivals and departures of our transports usually take place under cover of darkness, in the waste places of the Earth or in abandoned structures, which thereby acquire the reputation of being haunted by spirits."

"You brought your machine into the tunnel just now, or a few decades back, as if you didn't care who saw it."

"It bears a superficial resemblance to your own vehicles. You yourself were deceived. We know your train schedules, and by a little maneuvering in time can slip in and out between trains. In motion, the transport passes through a given instant so rapidly as to be invisible."

"Have you traveled this route frequently?"

"No. This is my first extended journey into the past. Also, this is in the nature of a trial run for this transport, which is newly constructed."

"Where are we going?"

"To that period which you know as the Renaissance. We have given it much attention. No doubt you are familiar with the idea that from a given moment in the present a multitude of possible futures diverge, of various degrees of probability. In like manner, a given state of affairs may be the result of a plurality of convergent possible pasts. By our knowledge of the free-motion transport, we feel obligated to ameliorate past conditions. The past is not immutable."

Livingstone stood up, drew out his cigarette case.

"So far as I'm concerned, I've heard enough of the past for the present," he declared. "A genealogist would have to be a person of no mean ability if he lived in your time. As things are now, the profession has no future in it. Do you smoke?"

"Smoke? What is that?"

"I'll show you," said Mark, and proceeded to demonstrate. "The makers describe this cigarette as slow burning, but they'd never believe it if I told them how long this one burned, and which way."

Halcyon watched with interest, then asked:

"What is it like?"

"Well, it's a mild sedative, and it tastes good. Probably that sounds odd to you. Want to try it?"

"I shall," affirmed Halcyon. "It intrigues me."

"Don't go too strong at first," cautioned Mark, as Halcyon drew deeply and then coughed. "You may make yourself sick."

BUT LIVINGSTONE had not reckoned with the somewhat different physiological constitution of Halcyon. The latter slowly consumed the cigarette down to a short stub, then cast it aside with a grand gesture. A flush overspread his face, the hairless portions of his scalp and his neck. His eyes glittered.

"Am I a man or am I an angle-worm?" demanded Halcyon, bounding to his feet and striking the table a resounding blow. "A trial run, is it? I'll show them a trial run! The Renaissance Period! Bah! Here I have a transport with a cruising range of one hundred eighty thousand years, and I'm sent on a preposterous, timid little journey of a mere sixty thousand or so! My

friend Livingstone, you are about to see such a burst of speed and such a leap in time as will make your hair stand on end!"

"Halcyon! Pull yourself together! You're tight!"

"I don't know what you mean, but I am not," asserted Halcyon, striding toward the control room passageway. "I'm walking on air! I'm a man inspired! I'm a flash of lightning crashing through the corridors of time! *YAHOO!*"

He vanished into the control room, and Mark waited nervously for some lurch or vibration of the transport, or other indication of augmented speed. Nothing of the sort happened, so he ventured to follow Halcyon. He found the latter seated, arms akimbo and jaw defiantly outthrust, before an unexpectedly simple instrument panel—a row of small white keys surmounted by a bank of indicator dials. Above them all was a quite ordinary-looking clock.

"The first four dials on the left have no pointers," observed Livingstone. "Why is that?"

"They indicate our passage through seconds, minutes, hours and days," replied Halcyon exultantly. "The pointers are rotating so rapidly that you can't see them. This one indicates years; once around the dial is a century."

The pointer in question was moving as rapidly as the second hand of a watch, and gathering speed. Livingstone hesitantly peered out of the cabin window.

From an altitude of several thousand feet he looked down upon what was no longer recognizable as the coast line of Alaska in the neighborhood of Cape Prince of Wales, the former—or rather the future—location of Tunnel Head. Arctic day and arctic night were merged into an

unvarying blue twilight. The sea was a motionless surface of bluish-gray, like a sheet of stone. The landscape flickered as if seen through a rapidly revolving shutter.

"The alternation of the seasons," explained Halcyon in response to Mark's unspoken question. "White to green and back again. We're entering the first interglacial epoch. Ha! Look at the century indicator! Now you can't see that pointer either!"

The coast line began to squirm like a lethargic snake, while the landscape heaved and shifted slowly. Islands rose from the sea, expanded and joined together. Livingstone wobbled back to the main cabin, dropped upon a cushioned bench, despondently rested his head in his hands. In the control room Halcyon broke into singing that was undeniably hoarse. After a period of time—millennia, to be precise—the singing faltered and ceased.

Mark raised his head and listened attentively. The sound of deep-lunged, regular respiration issued from the forward compartment.

"He's out," commented Mark to the empty cabin. "Like a light."

Then he became rigid. The light in the cabin was diminishing. It died altogether just as the transport came to Earth and grounded itself with a brief shudder. A clear white illumination filtered into the darkened cabin from the passageway.

Driven by a mounting uneasiness, Livingstone invaded the pilot's cabin for a second time, traced the pallid radiance to its windows. They were heavily coated with arabesques of frost which scintillated with the silver sparks of outer sunshine. Halcyon was sprawled in his seat, breathing heavily. Livingstone blew upon a window, melted a clear spot in the frost, and gazed into a blind-

ing white glare. All the pointers of the indicator dials were at rest.

"Halcyon!" shouted Mark, shaking him brusquely. "Come out of it! We've stopped. We're grounded. The lights are off and your window de-icer isn't working. I suppose that you have a de-icer. What do we do now?"

Halcyon stirred, opened bloodshot eyes.

"I'm on fire," he groaned. "My head is about to become a nova. That noxious little smoking cylinder — But this is humiliating! I must think myself out of this."

He sat erect, closed his eyes, clasped his hands behind his head, breathed deeply thrice. His features regained their normal color, and when he reopened his eyes they were quite clear.

"May I be a baboon's brother!" ejaculated Livingstone. "Can you teach me how to do that?"

"Could you impart the theory of polar co-ordinates to a baboon?" retorted Halcyon, rising briskly.

"I resent that!"

"It is a valid analogy, with no offense intended. But now we must appraise our present situation."

Halcyon scanned the dials.

"To be exact," he announced, "we stopped at three hundred nineteen thousand seven hundred two years, forty-five days, three hours and twenty-seven minutes negative from your take-off point—which means that we are well into the last previous major glacial period. And, to borrow an expression from your age, or perhaps one slightly earlier, we are out of gas."

"You mean—we're stranded?"

"Temporarily, yes. First, I must contact one of our transports. Second, I shall see that you are returned to the instant from which you set forth—unless you desire to

become one of our confidential agents."

"I do not."

"As you wish. Now, as to communications. Let me think. The principal transmitter in the central cabin is useless since our major reserve of energy is exhausted. But we have also a small self-contained portable transmitter with a half-million-year range in either direction."

"After someone has received your distress signal over this time-radio or whatever it is, how long must we wait?"

"No time at all. It matters not how distant in time or space our rescuers may be when they receive my call; they will arrive instantly. That is one of the advantages of rescue by time-machine."

"Then we may be here only a few minutes longer, and I've seen practically nothing of the outside."

"We have arrived during an interlude of sunshine," reflected Halcyon, glancing at the sparkling frost-coated windows. "You shall see the glacial epoch in one of its less forbidding moments."

SINCE the outer door could no longer be opened by the usual power-driven apparatus, Halcyon resorted to the emergency hand lever. The door slid open to admit a wave of merciless cold and a dazzling sun glare from a prodigious ice field. The frozen expanse sloped upward dizzily, its snow banks shadowed with pastel blue, to a remote shark-tooth horizon of austere hyperborean peaks—blue-gray, fretted with white veinings, plumed with snow banners—against the frigid blue limpidity of the sky. A retinue of spectral sun dogs linked by the pale arc of a solar halo attended the frosty sun. An inhuman silence enveloped everything.

"It must be thirty below zero!" exclaimed Livingstone, flapping his arms, and was startled by the loudness of his voice.

"I suggest that you speak softly," admonished Halcyon. "One cannot say what precariously balanced masses of ice may be poised up there, awaiting only some reverberation, some gust of wind, to come rumbling down into the valley."

Livingstone walked over the creaking snow and around the prow of the transport, started to whistle, then checked himself.

"We very nearly landed in the wrong place," he announced. "We're almost alongside a crevasse more than big enough to swallow your transport."

"It narrows downward," remarked Halcyon, leaning over the brink to gaze into its blue depths. "We would have lodged near the top. Let us return inside before we freeze our extremities."

A fantastic incident now halted them in their tracks. Falling from the open sky, a shower of miscellaneous debris tumbled into the crevasse with the tinkling fragrant impact of breaking glass and the staccato clangor of tinware. Ricocheting echoes reduplicated the din in a prolonged diminuendo. A small colorful object rebounded from the rim of the chasm and lay at their feet.

It was a can, an empty tin can, labeled "Superior Quality Tomato Juice."

"I should be immune to astonishment by now," cried Livingstone, "but this caps the climax! I suppose you have an explanation?"

"A passing transport threw overboard its accumulated refuse," Halcyon responded. "I would say that it was provisioned in the early twen-

tieth century. The label is indicative."

"I didn't see any transport."

"Naturally. It passed through this interval too rapidly to be visible."

A reverberating boom like the discharge of a distant naval gun sent the echoes rolling again. Responsive booms replied to it. The stranded voyagers turned quickly to squint up the glaring slope of the ice field and beheld half a dozen little white clouds, like puffs of smoke, hanging at the bases of as many mountain peaks, miles distant. The little clouds slowly elongated themselves down the incline of the glacier, hugging its surface.

"This compels us to make haste," Halcyon declared. "It appears that the noise of our rain of debris from aloft has started not one but several avalanches. We may or may not be in the path of one of them."

They hurried into the transport, and from a locker beneath the pilot's seat in the control cabin Halcyon produced a ten-inch black cube, held it pressed between his hands.

"This is the portable transmitter," explained Halcyon. "It possesses what I may describe to you as a thermoelectric trigger, actuated by the body heat of my hands. Since my hands, unfortunately, are cold, it will be slow in responding. Held thus, it will be placed in a receptive or recording state. Grasped by two other faces of the cube it becomes a broadcasting device. When activated through the third pair of faces it functions as a receiver and reproducer of incoming impulses."

While they waited for the cube to become active the transport began to quiver; various objects in its interior vibrated and jingled softly. A sustained muttering as of subterranean thunder became audible.

"We may have a very narrow margin of time for our escape," reflected Halcyon. "It is advisable that we station ourselves in the vestibule with the outer door open, so that when our rescuers arrive we may board their transport at once."

The opening door disclosed a seething, screeching, cannonading tidal wave of iridescent snow spume skidding toward them down the glacial incline at terrifying speed. Leaping chunks of ice shot out of its forefront, shattered explosively, or danced on its smoking crest like the solid components of a stew in a boiling pot.

"My nightmares usually end about here," Livingstone observed through chattering teeth. "I should wake up soon."

The cube became transparent in Halcyon's hands, revealed a dead-black sphere within.

"Now for the recording," said Halcyon, and flung his thought into the sphere.

SUCH was the substance of the instantaneous narrative.

The company in the receiving room of the morgue exchanged stupefied glances.

"It *was* a narrow margin of time," Wentworth said. "Too narrow."

"I'm getting out of here while I'm still sane!" cried Livingstone, and fled.

He found the authorization ready for him, as promised by Toby Flanders. With the little blue slip tucked in the breast pocket of his jacket, he emerged upon the platform of the tunnel station under Big Diomedes to find it deserted. He had missed the train for Tunnel Head by thirty seconds.

But there would be another train in fifteen minutes. He withdrew the slip from his pocket, examined it

with a smile of satisfaction, and replaced it. But, hold on! This was just the way things had occurred when—

An unscheduled coach was standing alongside the platform, windowless save for the darkened cab of the motorman. The rectangle of a door was outlined in its convex side by a hairline crack. Livingstone moved toward it with hesitating steps, irresistibly drawn but reluctant.

The door opened and a passenger came forth, garbed as a tunnel worker, to be followed by Halcyon.

"You again! I hoped that I could just forget about what happened in the morgue!" protested Livingstone huskily. "Regardless of destiny, I'm not coming with you!"

"Naturally, since you are forewarned," responded Halcyon. "Your thoughts clearly show me what has taken place. Do not think of destiny; it is an illusion. As I might have reminded you under other circumstances, but shall not—the past is not immutable and neither is the future. This is a most intriguing situation. A series of occurrences turns upon itself and prevents itself from happening. I received my own distress signal which you unwittingly transmitted, but by tracing its direction I knew that it originated here and not from the time originally intended. I have merely to close this door and continue upon my prescribed course, leaving you here, and the whole affair will be canceled."

The door closed, the transport vanished, and a crash like the *kwong* of a Chinese gong resounded in Livingstone's brain as a whole sequence of events receded into the realm of unrealized probabilities. In a multitude of minds all relevant memories dropped into the limbo of subconscious fantasy, to rise again to consciousness only in the imagery of troubled dreams.

Livingstone found himself fumbling in the breast pocket of his jacket. Why was he doing that? There was nothing in it. Now that he had personally visited Tunnel Head and had untangled the confusion of orders which had delayed a trainload of materials there, he had no time for loitering about the station.

As he hurried from the platform, the station disgorged a group of people.

"This trip is a wild goose chase, Wentworth," declared one of them petulantly. "A waste of the museum's funds. It's an obvious practical joke. One shift of excavators planted them in the ice, the next shift dug them out. Tin cans and broken bottles! Kitchen midden my eye!"

A phrase floated into Livingstone's thoughts:

"A given state of affairs may be the result of a plurality of convergent possible pasts."

Why the devil should he think anything like that?

THE END.



MISSION

By M. Krulfeld

He was sent to do one specific bit of sabotage in one specific way, with a specific tool—but the accident of a man's illness made death inevitable—

Illustrated by Kramer

AFTER the first few minutes it became almost a game. His hands on the rudder of the sky sled would sheer the tiny plastene ship away as he guessed where the next combat rocket would screech by on its way up. Mostly he was wrong. That May night of 2150 was dark, and the combat rockets traveled at a speed of thirteen hundred miles an hour.

Rocketing along on atomic blasts at a slow one hundred and fifty miles an hour, the tiny ship was saved from crashing only by the comparative emptiness of the substratosphere. Brant, as he stared upward through his plastene helmet into the stratosphere high above him, where the blackness was interlaced by the streaking flame of combat rockets locked in savage battle, knew that up there his innocuous little sky sled would have been crashed in a matter of minutes.

Below him the air was even more fiercely aflame under the high-arching barrage of mobile artillery as the robot armies of the American Federation and the Eurasian Union met in battle. A tight grin flicked across the Oriental face given Steve Brant by the surgeons. I'm an anachronism, he thought. Men didn't get into the battle line now. They couldn't. No flesh could stand the stress of air battles fought at a speed that would turn internal organs into bloody mush, or on the ground

where the jolting grind of the robot-manned tanks would smash flesh into blood and pulp against the metal walls.

Men could not even think battles through now, as a matter of fact. It was too complex, the details changed too fast; the vastness of the battlefield, the monstrous number of units engaged, and the speedy changes, could not be handled by any human brain. The old, old chess game of war had become too complicated for the human mind to play.

Robots guided the combat rockets and the bucking, smashing tanks. Battle Integrators, those most complex of all robots, did the thinking. Radio beams from each robot in action constantly reported back to the Integrators. Somewhere in the acre-spreading mass of those mechanical brains that information clicked into place, and orders were relayed back in less than a second.

Brant, and the line of battle, were over Mexico now. From the ground captured by surprise attack in Central America, the forces of Eurasia had smashed northward, while a fraction of their army held back the fiercely attacking but outclassed forces of the Southern Americas.

America now knew the reason for Eurasian victories—a new, superconducting alloy which made a saving of three thousandths of a second in integration time. With the bat-



With vacuum climbers, he stuck near the shadowed ceiling while they hunted him below—

laboratories were turning out the alloy at top speed, five or six months more must pass before the new American Integrator would be ready. Two hundred and thirty-three men had already died trying to slow down the Eurasian machine for those five months. Steve Brant was the two hundred and thirty-fourth.

His fingers relaxed a little at the controls as the line of battle became a crimson glow on the horizon behind him. Minutes ticked by quietly. It seemed very long.

Suddenly Eurasian 'Control Base was below him, an outjutting peninsula thrusting like a spearhead into the faint brightness of the lapping Pacific. Brant glanced at the chronometer set into the cowling of his tiny ship. Almost an hour yet. He had plenty of time.

Vanes poked out from the sky sled's sides. The atomic blasts died. In a great spiral, like a chip whirled in a whirlpool, they went down.

They hit water and went under. The plastene helmet and his flexible



ties fought at speeds of thirteen hundred miles an hour, that margin meant victory.

Although American factories and

high-altitude suit were waterproof, so Brant could breathe. The plastene slab of ship rose slowly as the friction of the water killed their

speed. Soon they were still, riding up and down the choppy waves, only two thirds of Brant's body showing above the surface. In the darkness it was impossible that he would be seen.

A single light flick of the rear blast sent them bumping gently into the cliff which rose sheer from the sea. It was smooth as glass and unbroken, a solid mass of plastene alloyed with metals, twelve feet thick and tough enough to withstand weeks of bombardment. Many lives had dearly purchased the secret location within it of three hidden escape ports for the Eurasian Integrator Corps in case of necessity.

BRANT LOCATED himself precisely under a particular escape port invisible in the blank face of the plastene cliff. He removed gauntlets from his hands and the helmet from his head and fastened them securely into the ship.

From a small compartment in the nose of the craft he removed four circlets of plastene to which were attached four special flexoid cups. He snapped them around his wrists, and then, with tortuous twisting, around his ankles.

A slap put one flexoid cup against the smooth wall. The internal structure of the small cups was such that each could hold two hundred pounds on a downward pull, though half a pound of lift got them free.

With his other hand he unfastened the straps holding him to the sky sled. He jabbed a small button on the side. With a faint gurgle, the vessel slowly sank. Magnetism would hold the nose against the wall at a depth of five feet. There it would wait for him—if he came back.

He set the cup on his other wrist against the wall. Slowly, carefully,

looking like some grotesque frog plastered against the cliff, he moved up.

At a height of twenty feet he stopped. After some delicate maneuvering, he got out of the rest of his high-altitude suit and dropped it into the sea, where it sank at once. Brant was now dressed in the uniform of a Eurasian guard, shockingly torn, tattered, and scorched. It was because this uniform, to avoid suspicion, must be dry, that he had kept his altitude suit on until no flying spray could reach him.

He went on. At sixty feet a prolonged search finally revealed a fine line in the wall. Crablike, he moved to one side until he was about three yards away from it.

He hung from the flexoid cups and waited.

It was some time later when the quiet was broken abruptly by the whining shriek of a rocket tearing down from the upper stratosphere. From Control Base an interceptor rocket rose belatedly to meet it.

There came a nerve-shattering shock on the plastene wall of the fort, precisely beyond the fine line of cleavage. A gout of flame licked at Brant's shrinking flesh. The plastene wall shivered. Brant was shaken like a rat in the teeth of a terrier. A warm spate of blood ran from his nostrils.

Quickly the shock was over. Even as the interceptor rocket sent the attacking rocket from the American forces down in a hissing belch of red fire, Brant was scrambling into the torn escape port, paying no attention to the hot plastene which seared his fingers.

Behind the torn opening gaped a tiny cubbyhole, scorched and twisted by the force of the explosion. Beyond the cubbyhole was a dark, high, narrow corridor, twisting

wormlike through the wall so that no projectile would get through without being caught in the curve.

A dark, bloody object was plastered against one wall, the tattered remnants of a Eurasian uniform clinging to it in wisps and bloody strips. White splinters of bone, charred at the tips, gaped out of the torn flesh.

Brant set his teeth. This must be Horinuchi. The smashed face would be a replica of the one the surgeons had given him. Even the man's history, actions, and emotional reactions he knew by rote.

Swiftly, mouth tight, he pulled the crushed, bloody thing from the wall. He ripped off the tattered uniform and hurled the body out into the sea.

Into the dark, high, curving corridor, he leaped, pulling off the flexoid cups. A slap fastened them high and almost invisible at a dim curve of the wall.

Back into the shattered cubbyhole. He pulled a small heat torch from his pocket. The bloody rags flared quickly and became a scorched mess. The bloodstains on the wall became a black smear of soot. The stench was not perceptible above the smoky odor left by the explosion.

Swiftly, now! Time was running. The torch turned on himself, at a much lower heat. He bit his lips in agony as he scorched his own flesh to tally with the holes in his uniform, prepared beforehand by surgeons so that he could burn himself terribly, yet not badly enough to kill or injure himself permanently.

Footsteps running down the corridor!

He closed his eyes, held his breath, and sent a jet of flame into his face. A toss. The torch spun out and down into the sea. Now he had to knock himself out, to be

unconscious when they found him.

The wall, twisted and scorched, loomed bigger and bigger as he dove for it headfirst. Crash—pain—blackness!

SOMEONE was shaking him. His head ached damnably. His flesh burned and smarted. His skull sent a throb of unendurable pain flaring through his nerves with each shake.

Words were being whispered harshly into his ear—English words, spoken with an accent: "Wake up! Merciful heavens, awaken! We have no time—"

Brant's eyes came open. He stared into a flat, thick Oriental face, the features contorted with anxiety. "Who—"

"I'm Gomez. From Bolivia. In here as Boris Markov, a Siberian. Listen! Horinuchi is in sick bay with a broken arm!"

The disaster struck Brant in its full enormity. Horinuchi was the part he was to play!

"Who was the guard?" he demanded.

"Cho Liang. A north China man."

Brant's fingers dug into Markov's arm. Somewhere he could hear the muffled clangor of an alarm bell. "Listen! Get me out of here, unconscious. Tell those you meet to stay here in case of attack. You yourself will take me to sick bay. I'll be Cho Liang, my face smashed unrecognizably. Slam me on the floor. Use your boots if you have to. You understand?"

"It's clever." Admiration shone in Markov's eyes. "But—"

"It's the only way I can get in. Even so, I don't dare really go to sick bay. Drop me somewhere. If I can get at the Integrators during the confusion, I'll be able to do some damage."

He recovered the flexoid cups and stowed them away, now that he could not be searched without disaster anyway. "All right. Now!"

His teeth set. His eyes closed. He lay face down on the hard, unyielding floor. Markov's fingers gripped his hair.

His face went down—

When consciousness returned, his mind was clear though his nerves were alive with pain from battered face and scorched body. He was tumbled like a sack over Markov's shoulder. Clattering boots hurried by. Harsh voices rasped orders in the mixed polyglot understood by all Eurasians: "Escape Port 3! On the double!"

The thud of boots went on. Every step sent a jolt of pain through Brant, though he pretended unconsciousness.

Finally the rush of footsteps faded out. Brant did not move. "Anyone in sight, Markov?"

"No one," Markov whispered back.

"Where are we now?"

"In a corridor leading to the center of Control Base."

"Any side doors to Integrator Sector on the way?"

Markov answered at once. "Yes, but they're sealed against all but Integrator Corpsmen."

"When we get to it, stop beside the door and I'll see what I can do."

Markov trotted through the echoing corridor. Once there came a metallic clangor as a rapid-fire mobile cannon was trundled by.

"We're there," Markov muttered at last.

Still hanging from the other's shoulder, so they could immediately start again for sick bay if anyone showed up, Brant opened his eyes and looked at the sealed door.

Exultation pulsed through him.

The seal was of the magnetic-interruption type. The combination had been discovered scarcely three weeks before by Military Intelligence in an entirely different connection. The agent who discovered it had since been executed, but without the Eurasians realizing that their secret was a secret no longer.

BRANT SLIPPED from Markov's shoulder. Stooping, he twisted the heel of his shoe. It pivoted to one side, showing a hollow two inches in diameter and half an inch deep. It was packed with tiny but efficient tools and minute vials. From among them he picked a tightly coiled magnetized wire which sprang out and straightened in his fingers.

He inserted the tip of the wire into the tiny hole of the door seal. In and out it went in a rhythmic pattern.

Three seconds later, Brant pulled the wire out, dismay on his face. There was no click, no movement of the massive door.

He struck at it in futile exasperation. As soundlessly as before, it gave beneath the thrust.

Brant swung the heel of his shoe back into place. It was a primitive hiding place, but effective. Once suspected, no hiding place would serve. Until suspected, he would not be searched.

He turned to Markov. "Your identity is well established?"

Markov nodded. "I was stationed in Siberia for years in this character, long before the war came."

"Good! No matter what happens to me, you must remain and be useful. You realize they would recognize me as Horinuchi's double in sick bay as soon as the blood and scorch were washed away. My only chance is to do as much damage as possible before I'm caught."

"But you won't have a chance —" Markov protested.

"Better men than I have died on this job. I can only do my best," Brant said grimly. "To protect you, I'm going to steal your heat torch and burn you in back of the head. It will be bad enough so you could be either unconscious or conscious. Go on down the corridor. If you meet no one, pretend you collapsed near one of the Integrator Sector entrances, or better yet, near the main power room. Say I grabbed your torch and rayed you down while you carried me. If you do meet someone in the corridor, act dazed and vague. You understand?"

Markov nodded. "Good luck," he said simply, and turned, his back to Brant, waiting.

Brant lifted his torch.

"Very affecting," a harsh voice said behind him. "Don't move!"

Brant stood rigid, frozen. His spine felt cold.

A click, then a faint hum. The Eurasian had snapped on his headquarters phone. "Send a detachment of guards at once to Integrator Door Y7—"

Brant's body dropped abruptly to the floor. As he fell, he twisted about, his heat torch, the slide shoved on full, whipping back.

A curse ripped from the lips of the Eurasian, a dim figure in the faint light of the Integrator corridor. From his hand a narrow, pencil-thin beam of glaring light flashed out.

A stifled scream came from Markov. He fell to the floor, thrashing and twisting in pain.

As he saw the Eurasian's hand angle down on him, Brant's forefinger pulled back. The thin red rod of intense heat lashed out. For a split second the slant eyes and high

cheekbones of the Eurasian were etched in the red glare like a demoniac mask.

Then his knees buckled and his shoulders bent. He fell. One outstretched, clawing hand fell across Brant's shoulder.

Brant came to his feet. The Eurasian was dead. He whipped around. Markov had stopped moving. A black hole was burned into his uniform, and he, too, was dead.

IN ANOTHER MOMENT the hue and cry would be on. Brant stooped, plucked up the heat torch which had rolled from the guard's lax fingers. It took forty precious seconds to detach the headquarters phone with its tiny batteries and receiver-transmitter from the belt of the dead Eurasian.

A shove sent the massive door clicking into place. Brant raced down the dim, narrow corridor which led to Integrator Sector of Eurasia's Control Base.

His time of grace was measured in seconds. If he was very lucky and the Eurasian command very confused, in minutes. He clicked on the phone taken from the dead man. He listened as he ran.

"Yamato! Integrator Corpsman Yamato!" Again and again the call came from the phone.

That would be the dead officer, of course. Brant's eyes burned in his aching, pounding skull. Wouldn't this damned narrow corridor ever come to some side entrance, some hiding place? If he was caught in this cul-de-sac between two parties of guardsmen—

"No answer from Yamato, sir," the operator reported half inaudibly in the hissing jargon of Eurasia, to some officer beside him, probably.

Before Brant the dim corridor stretched interminably, unbroken,

narrow, seeming to close in in the distance, like some trap baited by a devil.

Suddenly the phone broke into a crackle of excitement. "Look, sir! The dial! The light line across Corridor Y7 has been broken! Someone coming toward Integrator—"

Brant whipped around, glaring at the wall behind him. There it was! Waist high, a dim beam shooting from one tiny inconspicuous hole in the wall to another hole in the wall opposite. They had him placed now!

The voice in the phone, high and harsh with excitement, was sending out orders: "Guard details C and K! Advance at once to Corridor Y7, detail C from outer side, detail K from Integrator Sector side! Enemy spy believed in corridor. Try to capture him alive, if possible, but give no opportunity of escape!"

Brant put on a new burst of speed. The vein at his temple felt like a rope stretched to bursting. It throbbed, and every pulse was like the beat of a hammer against his wincing skull. Speed! He had to—

Ah! His bloodshot eyes, watching for it, saw the tiny holes in the wall ahead. He flung himself under the beam, pulled to his feet, and raced on.

He came to a sudden, sliding halt. There, set flush into the wall, only a thin rectangular crack defining it, was a door. There was no lock.

He pushed with vicious strength. It held.

The scuffle of running feet sounded, magnified by the narrow, confining walls of the corridor to a dull thunder, distant and ominous!

He choked down the sobbing gasp in his throat, pushed down the panic which threatened to swamp his intelligence.

There must be some way to open

the door! No sense in a door that would not open!

His glaring eyes shifted in his scorched, puffed face, the only moving things, the only thing alive about his taut body.

There! Near the floor! A place a little soiled, as if—as if scuffed by a kicking toe!

He kicked out. At once the door swung wide.

THE CHAMBER was a high, big storeroom constructed crudely of native stone. A single bulb lit in the ceiling as the door came open, only to die out again as he swung the door shut behind him. He had to use the dim red light of the heat torch, on low. Only a few cases packed with goods and a couple of empty crates broke the bareness. When the single bulb was on, there was a spot of brightness in the middle of the room, fading off to dimness and a murky dark around the walls.

Brant knelt swiftly, snapped on the flexoid cups around his ankles and then his wrists. Up the darkest wall he clambered, to become a darker shadow clinging to the wall just under the ceiling.

It was his one chance. They would not expect him clinging like a fly near the bare ceiling. If they searched this chamber—and they would unless their commander was an utter idiot—they might not look high enough.

The seconds passed. The heavy door shut out all sound from the corridor outside.

Click! The door flung open, and the bulb in the center of the ceiling bulged with sudden light. It seemed to him that every ray of it was focused on him, that the men below could not help but see him. He held his breath.

"Search those crates carefully," one of the three men said. Outside the open door other guards hurried by with a scuffle and thud of leather.

Cautiously, heat torches ready, the two approached the crates. The other man, torch also ready, watched from the doorway.

Thump! With a clatter an empty crate turned over as one of the guards kicked it. More thumps. The creak of rusty hinges.

"Not here, sir."

The leader nodded. He swung around, the faint red glow of his torch, on low, reaching into the dim corners of the chamber. "All clear here, I guess."

The door closed behind them and the bulb in the ceiling faded back into darkness. For a long minute, Brant's muscles relaxed and he hung loosely from the flexoid cups, his breath coming in great, painful gasps.

Back on his feet again, he leaned against the wall and thought swiftly. Then he stooped and took off his shoes. A torn strip from his tattered uniform tied them together and he swung them over his shoulder.

At the door he stopped, listening for a long minute. Anxiety was like a tiny gnawing animal inside his skull. To wait too long would show the Eurasians he was not in their net, and they would spread out again. To go out too soon and stumble into an extra guard party would be swift destruction.

His hand sought and found a handle on the inside of the door. He lifted. A sharp click, and the door came open.

As it opened, the bulb in the ceiling came on. On the inside of the door something showed clearly which he had not noticed before. Breath

caught in a sharp gasp, he stared at it.

It was a map. A second's study showed that it revealed nothing of Integrator Sector itself, but merely traced the corridors surrounding it. Clustered thickly along the corridors were small diagramed rectangles, each one filled with minutely penciled notes. These must be storerooms.

He pulled the door shut again and, by the dim red light of his torch, studied the diagrams intently. A plan was half formed in his mind.

Ah! There it was! One of the storerooms on Corridor V3, among other items, showed three spare intensity tapes!

INTENSITY TAPES were in some respects the very hearts of every Integrator system. They were chemical bands about three inches wide and approximately a hundred and ten feet long, wound into the Integrators in a continuous loop. Reports sent back from each combat robot relating to size and number of enemy forces were in the form of light flashes. Each report flashed at precise points against the rapidly whirling intensity tape, all the reports combining into a visible picture of the enemy's strength, instantly available and totalized. The whirling tapes then passed through a multitude of scanners which, according to the totalized strength and position of the enemy, relayed a complex of orders to the multitudes of reserve combat robots. At the completion of one revolution, the previous picture faded from the tape, which received new impressions once more and whirled again through the scanners. A complete picture of the situation in each battle area was available at intervals of a minute and a half, the time of

revolution of each tape. A tape was good for well over six months. Intense scientific research had made them at once sensitive and extremely durable.

Brant looked feverishly for one other item. Finally he found it.

Luck, which had been against him in other things, was with him now. Spares of the special cog which connected the tape to the motor source were kept in a storeroom next to the one containing the intensity tapes.

Swiftly, he left the chamber. His bare feet making no noise on the hard floor, he ran swiftly toward the cross corridor which connected corridors Y7 and V3.

Every nerve in him was alert. The torch clutched in one hand was ready, the slide shoved over to full intensity.

The harsh voice of the operator sounded in his ears again. "Attention! All guard details, attention! The spy in Corridor Y7 is still at large. Two men will cover every corridor ending in Integrator Sector. Two others will proceed up each of those corridors, in pairs. Storerooms en route will be carefully inspected. Those capturing the spy will be recommended for immediate promotion."

Brant swore under his breath, but ran grimly on. He came to the cross corridor, then to Corridor V3. Unmolested as yet, he reached the storeroom which contained the intensity tapes.

Everything here was meticulously arranged. The tapes, in tight plastic cases, were easily found. Off came one cover. The tape lay in a tight coil in his hands.

His fingers were shaking. He licked his scorched lips and shook his head angrily. The excitement which had kept his nerves strung up against the hurt of the last hour

was beginning to leave him.

He gripped the coil more tightly for a second. Then he forced himself to relax and placed the tape on a shelf. His torch, on low, went beside it for illumination.

From the cavity in the heel of his shoe he removed a piece of absorbent material about five inches square and tissue-thin. From a tiny vial he poured a few drops of colorless liquid onto the tissue and wrung the latter to spread it evenly. When it was done, the tissue was faintly damp.

He folded the tissue over the end of the tape. Holding it pinched over the band with the thumb and forefinger of one hand, he pulled the tape through with the other.

It made a whispering sound in the stillness. Second after second, minute after minute— He dared not hurry. The Eurasians must not know the tape had been tampered with.

It was done at last. Working with fingers that were steady despite the nervous strain which made his features twitch and his teeth sink into his lip, the intensity tape was rewound and stowed back in its case.

He hesitated a moment. It would be best if he could treat the other two tapes as well. The chemical in the tissue weakened the reaction of the tape to light. Not much, but enough to throw the delicate mechanism of the Integrator off. Insufficient reinforcements would be sent to important combat sectors. Not every time, but often enough so that the progress of the Eurasian war machine would become a creep or a halt. Eurasian forces would be unable to push through to final victory before the new Integrator for the American forces was at work, changing the entire situation.

Reluctantly, Brant decided there was not enough time to treat the other tapes. But since the treated tape was on top, it would undoubtedly be the next one used. It would be months before the Eurasians could trace back the fault in the complex Integrator to the intensity tape. Particularly as the slowing up could be attributed to an improvement in the American Integrator.

He removed all traces of his work and strode purposefully to the door. His fingers touched the handle.

It moved even as he touched it. With a gasp, he leaped back and to one side.

The door swung open.

"Did you hear something?" The two intruders stood back of the doorway, outside his line of fire.

"I'm not sure—"

"Stay back! The spy may be—"

No TIME for planning. Already Brant's fingers had shoved the slide of his torch to full intensity. His other hand went up, gripped the strip of cloth which bound his shoes together over his shoulder.

Full into their view, he leaped. The torch sent out a beam of intense red at one, while his other hand flung the shoes at the face of the second guard.

Two thin red beams blazed back at him. Heat tore at his face. For a split second of agony everything but the pain became dim for Brant.

Through blurred eyes he stared at the guards. One was a thrashing, moaning thing on the floor, hands pressed to his middle. The other, blood streaming down one side of his face where the shoe had struck him, had his torch leveled for a second blast.

Brant flung to one side. The thin red of the beam missed him, hissing through the air to one side.

The torch of the guard twisted to follow him. His own torch sent out a lance of thin red that ended at the Eurasian's throat. For a second the man remained standing, immobile.

A horrible gurgling sound came from him. He slumped and fell.

Brant shivered as he struggled to his feet. The wound in his own face, burning like a hot iron continuously twisted in his flesh, was a small scorched hole which had nicked his lower lip and passed through his left cheek.

His teeth set hard at the pain, he went through the door, shoving it to behind him. The guards must on no account be found here, lest the Eurasians guess the tapes had been tampered with.

He picked up the shoes and slung them across his shoulder. Then, gripping the slack of each dead guard's uniform, he dragged them down the corridor as swiftly as he could.

The phone, still clasped to his head, burst into furious warning. "All guards attention! The detail searching Corridor V3 has stopped reporting. Guards in V2 and V4 investigate V3 at once! V3 detail, report back! V3 report! V3 report!"

Brant's breath came in a wheezing sob. Would he never reach that next storeroom? At any second there might come the thud of running feet along—

Ah! There it was!

He kicked at the door and it came open.

No time for elaborate secrecy now. He left the door open and the bulb in the ceiling remained on.

Swiftly, even as his avid gaze swept the place to find the all-important cog of the Integrator, his

fingers were fumbling for a certain tiny vial.

He had it out and the cap off. He was still seeking through the shelves.

That one on the right! He leaped toward it. The cogs were arranged there in a neat pile, one on top of the other.

Delicately, he tipped the tiny vial, poured a thin, almost invisible thread of sticky, sluggishly flowing liquid onto one side of the cog, then the other.

Where that thread of liquid lay there was a sputter and a sizzle, and a little yellowish cloud, biting and acrid, rose from it. When it stopped, the tiny thread of destruction bitten into the metal was almost invisible, but Brant knew it ran deep. Brant drew his thumb over the break, once and again. To outward seeming the cog became one unblemished piece.

Carefully he replaced it and ran from the storeroom. As plainly as though it were happening before his eyes, he could see what would occur. The cogs wore quickly, and had to be replaced every few weeks. Shortly the defective cog would replace the one now in use. Almost at once it would fly into pieces from the stresses imposed on it. Grinding and tearing, the high-speed works of the Integrator would smash and jumble in a second. The intensity tape would rip and break. For some hours, while repair crews worked frantically, makeshift substitutes would direct the Eurasian combat robots, until finally the Integrator was repaired, with a new intensity tape—the doctored one—replacing the one which had torn.

He slammed the door behind him. Swiftly he put his shoes on again. One more minute was all he needed.

He dragged the bodies of the two guards along with him again. The cross corridor was not far away.

He heard the sound of running feet, but they were still distant. He would reach the cross corridor before them, without being seen.

There at last. He dragged the two bodies into the cross corridor and placed them carefully. It must appear that the dead guards had heard him in the cross corridor, had run after him, and been killed there. Nothing must show about the two all-important storerooms. So!

The running feet seemed very near now. He had perhaps fifteen seconds left. Time enough, and to spare.

He turned and ran, away from the approaching guards. He heard their shout of rage when they found the two bodies. Well, they would have their revenge soon enough!

He couldn't run as fast as his pursuers. Strange, how weak he suddenly felt. His mouth and cheek burned intolerably.

Ahead of him sounded other footsteps. They had him trapped between them. He was caught. No need to run any more.

It was good to rest. The thought flashed briefly and gratefully through his mind as he turned to face the guards who were nearest.

To the Eurasians he would be another spy who had failed.

He was grinning, a wry, distorted, ghastly grin on account of the wound in his face, when the pursuing guards came on him.

He raised his torch. It was only a gesture, but, of course, the Eurasian guards could not guess that.

The brief, brief flash of red heat beams—

A mission was finished.



TEST OF THE GODS

By Raymond F. Jones

The Earthmen were taken for gods—but had to act in a way the Venusian reptiles would think godly! And what was the moral sense of a Venusian apt to demand—

Illustrated by Kolliker

THE VENUSIAN rains spume down from the skies as if there's nothing in that hell-bound world but water. Warm water. Green, slimy water that trickles through the fern mesh and drips timelessly onto the oil-soaked roofs of the aborigines' huts.

Spud Agill stood slump-shouldered by the open door. His breath was short in the steam that enveloped them. Hot sweat rolled down his forehead into the bush of his eyebrows.

"We've got to break for it to-night," he muttered decisively. "They're just waiting for us to die! Can't you hear them out there? The slimy devils—"

An echolike chuckle came out of the fog across the hut. "And just where will you go, my good Agill?" It was the Deacon talking. "To the north and west are a thousand miles of ocean crawling with ichthyosaurs. To the east is twelve hundred miles of jungle—thick, beautiful jungle,

alive with stegosaurus, triceratops—before you get to Aspia. Southward is the swampland. You don't mean to try that?"

"We don't have to!" Spud snapped. "We were fools to leave the ship. We could have starved until we repaired the lifeboat. It was only five days' job at the most for the three of us. But we can go back to it. Are you with me?"

"Yes! Yes! Let's do anything! But let's get out of this hell!" paunchy Joe Spencer breathed heavily from his corner. His bulk shifted fearfully before the mist of light that was the window across the hut. He shuddered at the scaly forms that oozed out of the fog momentarily, then were folded back into it. "They're watching us!" he whispered hoarsely. "Maybe it's too late."

The three men watched, haunted by the unending soft hush of rain about them. Rain that condensed rather than fell.

Three weeks ago they had boarded the *Minos*, Agill's dilapidated flier, for a trip to the newly open two hundred thirty-five fields, halfway around the planet from Aspia.

There was always good pickings in new mining fields—suckers to buy gold bricks, Joe Spencer's specialty, lucky prospectors to be chiseled out of their finds by guns, fists, or any other means available. Spud Agill wasn't particular in these matters.

And the Deacon could manage a good confidence racket behind the flaps of a revival tent in almost any environment.

But with only twelve hundred miles of their journey behind them, the *Minos* gave up and dropped them in the depths of the Venusian jungle, where no man of Earth or Mars had ever penetrated, and of which there were only legends and

rumors among the more advanced peoples of Venus.

Making a hunt for food to last until the lifeboat could be repaired, they had been captured by the reptilian inhabitants of the jungle.

All of the men had seen life in thousands of forms and degrees of intelligence on the three planets they knew, but their captors baffled them. Three-toed, or rather, clawed, they walked upright. Their forms resembled the tyrannosaurus, yet they were only slightly larger than the men. Their bodies were finely scaled or plated, and dripped constantly with foul-smelling water that condensed on their cold forms and absorbed their dank animal odor.

But they were intelligent. They spoke to each other in high, piping voices, and for three weeks had been patiently teaching the men their weird language. They called themselves Igoroes.

Joe Spencer came away from the window and resumed his endless pacing across the narrow hut.

"Agill! You've got to get us out of here. It's driving me crazy. This rain and those slimy, ghostly—"

"Oh, shut up!" snapped the Deacon. "You know we can't get past those guards. Besides, we don't know that they plan to harm us. It seems to me that we've been treated rather royally, according to their ideas of royalty—especially after Spud was so anxious to try to prove to them that he was a god. Where'd you get that flash of genius, Spud? Out of those wild yarns you read, or is it just a hidden superiority complex breaking out?"

"It worked." Spud thrust his chin out defensively. "They were impressed enough by a few old-fashioned card tricks to feed us the best they've got for three weeks—even if it is pig swill—instead of burying

our heads in the ground with our feet sticking up."

"Yes, maybe they figured your show was worth more ingenious treatment and they've spent these three weeks figuring it out."

"Stop it!" Joe screamed at them. "Don't stand there arguing. Do something—let's get out of here!"

"Maybe—" The Deacon began, then he closed his mouth and stared silently out the window.

Through the gray billows of fog and steam a host of scaly forms was moving. The squoosh of their feet in the mud and slime was like the sound of distant, stampeding cattle.

Still half hidden by the curtains of vapor, the horde paused, then stopped. After a moment, a trio of Igoroes stalked slowly forward.

"The delegation of honor," murmured the Deacon. Spud remained silent, jaws clenching and relaxing.

Joe was in hysteria. "Don't let them take us! Don't—"

"Quiet, you fool!" Spud ordered.

THE THREE approached the hut. Just outside the door, they carefully laid their hardwood spears on the ground. They knelt on one knee in the doorway.

"God—and devils, come," the middle Igoroe hissed. His whole body seemed to quiver as if from extreme nervous tension.

The Deacon hunched in his corner. "God and devils? Where do they get that stuff? Just because Joe and I can't do card tricks—"

"I think we'd better go," said Spud.

Joe was near collapse. The Deacon rose with rheumatic stiffness and joined Spud in wrapping a supporting arm around Joe. The three sloshed into the rain ahead of their reptile escorts.

Stumbling through the mist, they

made out the forms of hundreds of assembled Igoroes. Silent and motionless, the horde looked upon them as if in impassive judgment. The occasional lightning flick of their inner eyelids was the only sign of expression.

The stench of their bodies was sickening.

"Looks serious," the Deacon admitted.

The group began slowly closing in behind. Those in front knelt before the pressing reptiles in back. At last, one of the three escorting Igoroes raised his scaly arms for attention. He began hissing in their sibilant tongue.

The three Earthmen strained their ears to catch the meaning of the words. To their minds it was:

"O Igoroes! The greatest of days has befallen us, when the legend of a thousand fathers ago is fulfilled. Our god has come among us, falling from the skies as was foretold. But, even as was also foretold, the two devils have accompanied him.

"Upon us is the greatest of honors and the most sorrowful of responsibilities since the planets flamed. We must discover which is our god and which are the two devils we must annihilate. If we fail, our god will buy his freedom with us and flee, and the devils will rule over us and our children until the worlds flame again!"

A shrilling, mingled hiss of approval and heart-tearing despair came from a thousand reptile throats.

"We must make the test of the gods," they intoned.

"What'll we do? What'll we do?" Joe moaned over and over again.

"Figure out how to pass the test of the gods." The Deacon leered at him.

"Lay off," Spud growled. "We're

going to need all we've got to get out of this."

The Igoroe turned and addressed them. "You know which of you is our god and which are the devils we must destroy. We do not know. May our god forgive us the humiliation of having to make a test to identify him and help overcome those who hold him in power.

"We will ask three questions, each to be answered by one of you. Only our god can know the answer, because the devils cannot pronounce that which is good."

The Earthmen stood in rigid surprise. What kind of aborigines were they? No primitive torture. No pagan ceremonials—only three questions.

The Deacon glanced about. He sensed in the tense forms of the reptiles that this was the greatest event in the lives of any of them. He silently cursed the fate that had dropped them as ready-made answers to a wild, dream-founded legend. But it had happened before—Cortez and the Incas on Earth—he reflected. Only things were a little backward here on Venus. The Venusians weren't as gullible as the Incas.

He looked at his companions. Blubbering Joe, stiff as a corpse with fear. Spud, silent, worried and burning with rage. Only one of them could get out of this—

"What is the first question?" Spud asked quietly.

The lizard man spoke reverently. "The question: What must an Igoroe do if he injures or sees an injured Igoroe?"

Spud frowned. "That's a hell of a question," he said in English.

But Joe had blossomed like a poppy. "That's easy. What would a god tell 'em to do? I'll give that one!"

He shifted to hissing Igoroe. "The Igoroe must help—"

Spud slapped a hand against Joe's mouth. "You damned, brainless idiot, shut up!"

"Stall for time," whispered the Deacon. "Get a day."

Spud addressed the Igoroe. "None of us will answer now. We require one day. Give us until tomorrow at this time, then come to our hut and receive our answer."

A ripple of hissing went through the assemblage. Evidently this was not according to the books. After a moment of consternation the three leading Igoroes conferred in calm, deliberate discussion.

The Deacon watched through narrowed eyes, studying intently the Igoroe's reactions.

He could distinguish males and females side by side in the crowd. Little monsters of baby Igoroes moved restlessly in and out, but even they were attentive and comparatively still. The Deacon observed half a dozen mothers with tiny, squirming lizards in pouches at their waists. An insane cross between reptile and marsupial.

One fact centered itself in the Deacon's mind: the lack of frenzy and bloodlust. The Igoroes were on an infinitely higher plane of emotions than their filthy animal surroundings would indicate. At least, judging by Earth standards.

But another possibility clamored for recognition in his unwilling mind. Perhaps the Igoroes were simply emotionless. Yet that seemed impossible. Fear and excitement left clues in their manner. He shrugged off the idea. The Igoroes were emotional enough. Where was the key to unlock their emotional pattern?

At last the discussion ended and the Igoroe leader announced: "We will come for our answer and bring

the next question in one day. One of you will answer. If it is the answer of a god, he will be asked the next. If it is the answer of a devil, he will be destroyed."

Endlessly, the rain sprinkled the steaming soil.

JOE'S craven fear had vanished, and he blustered confidently. "What is there to worry about? Boy, how you pushed 'em over with those card tricks and that god business. They even went out and dug up an old legend to fit us. All we gotta do now is answer their questions, and one of us will be the head man of the whole mob. The other two will be safe enough, because whatever the head man says goes. Then we're sitting on top—pick up any crown jewels that might be laying around, fix up the *Minos* and take off."

Spud glanced down at his little fat sweating companion. "The wheels don't go around often, do they, Joe? But when they do, they sure buzz."

"Why? What's the matter with my idea? Why wouldn't you let me answer them? Naturally, the nice thing for a god to say would be that when an Igoroe is hurt, the others help him. You haven't been slitting throats so long you couldn't figure that out."

"How do you know?" grinned the Deacon. "Were you ever god, Joe?"

"Aw, you're both crazy. What are you driving at?"

"Nothing," said the Deacon, "except I wondered if you'd ever seen a pack of wild dogs turn cannibal when one of them showed blood."

"What's that got to do with this?"

"Nothing, except that our friends outside might have a similar code of ethics, and it might be the social thing to take a nip out of anybody who is down."

Joe paled. "The— Then how are we going to know what answer to give them?"

The Deacon laughed in Joe's face, a laugh of wholehearted amusement at the panic this simple thought brought to Joe's mind in which walls of Earth standards were built so high that Joe was incapable of thinking in any other terms.

Spud was pacing the room, trying to think logically, but his rage prevented that.

He stood at the door, wiping the sweat from his face. "We're in for it now. They're ten deep all around us. They'll probably be there all night. I don't think they ever sleep."

"I hope you still aren't thinking of breaking for it!" exclaimed Joe. "Not with everything working our way."

"It would have been a hundred to one chance before. It's zero now. But finding the right answers to their fool questions isn't more than one in a million. Out of thirty known races on Mars and Venus, only one has a code of ethics that can be anywhere near duplicated on Earth. A mathematical physicist had no business discovering relativity; it was a sociologist's job. There's only one thing in this cockeyed universe more relative than social customs, and that's ethics.

"These Igoroes know the 'right' answers to these little ethical problems they're giving us. From a few weeks' observations of the few specimens we've been able to see through this haze and muck we've got to identify their whole ethical pattern—or else toss a coin to get the answers. What's the chances, Deacon?"

The Deacon had slumped down in his corner, thinking hard. What he was thinking most was that only one

of them could survive. There was nothing to fear from Joe, but Spud had to be led off.

The Deacon's Ph. D. had come from his work on comparative ethics—before he discovered wits were more lucrative than wisdom. That made him the logical survivor in this insane contest, he reflected.

Joe cut in with injured dignity. "I don't care what you think! If they ask me, I'm going to tell them to help the damned, infernal injured Igoroe until he gets well!"

With that he retired from the discussion.

"We've got to know at least three more factors," said the Deacon. "First, how does their ethical code rate according to our own standards? Have they any science? Do they believe in an after life?"

His narrowed eyes watched Spud's face closely.

"I'd say they were a peculiar mixture," Spud answered. "They lack developed artifacts, but their lore and natural science are high. Their use of herbs has developed into a fairly good traditional medicine. Geometry and astronomy have probably reached the Euclidean stage. I'd say their ethical system is high according to Earth standards."

"Why?"

"Hunch, maybe. But it seems that way—no howling or war dancing around us out there. Their attitude was one of high devotion rather than fanaticism. And the family-group stuff—did you notice that?"

The Deacon nodded. "I think you're right about the ethics, but if they had geometry they'd have buildings and artifacts. No, they don't know anything about the sciences. Just about the reverse of Earth a couple of centuries ago—they're long on ethics, but short as zero on science."

"Perhaps, but in that case their traditional medicine must be advanced. Living in the jungle, having the intelligence they have, they must have a great herbological lore."

"You didn't see any medicine men hanging around our little ceremony out there."

"I wouldn't have known one if I'd seen him. Perhaps they have no concept corresponding to our 'medicine men.' But that has no bearing on the question. Medicine men as we think of them are not embryo M. D.'s. They're priests of superstition. And there's plenty of that around here. If it weren't, we wouldn't be in this jam! But it's a high mysticism like the great religions of Earth—Buddhism, Christianity, the Inca beliefs."

"Then we can take our answer to their question from the pages of our Earth Bibles?"

Spud shrugged. "I don't see why not."

The Deacon smiled. He didn't, either—yet. There had to be one more factor. Three points determine a line; three relevant factors determine an ethical pattern—if you interpret them right.

IN THE NIGHT the guards trebled and the horde of curious, intent Igoroes pressed closer. The stench of their lizard bodies filled the little hut.

Even Spud knew it would be suicide to venture an escape. Through the lowering dusk he had watched them pressing in, and in the blackness he could hear them shifting, sloshing in the water and muck.

The rain increased, torrenting down from the sky. It swept the matting loose on the roof and let warm trickles through onto the men.

Asleep with weariness, they rolled endlessly, trying to keep out of the water, but there was no spot on the

dirt floor that was not being drenched.

Dawn came, drear and lifeless. The Earthmen shifted their aching bodies to upright positions and glanced about. They were sitting in an inch of water.

"Today's the day," muttered Joe.

He surveyed himself and his companions. He looked down at his legs, crossed in the water—

"Gods!" He suddenly burst out laughing. "Funny, isn't it? Us, gods!" He shook and rocked back and forth.

"Joe! Joe!" Spud reached over and slapped him across the cheek. "Stop it. Do you hear?"

Joe subsided after a moment, looking momentarily ashamed, then burst out crying. "Why don't they kill us and be done with it? What are they waiting for?"

There was an awkward trampling at the doorway. An Igoroe entered with breakfast.

"Cheer up. Swill's on," said the Deacon. He took the bucket-sized gourd from the Igoroe and smelled the sour mess that seemed to be half-decomposed fruits and berries.

Joe turned paler and grabbed at his stomach. The Deacon busied himself with the gourd and casually turned to the Igoroe, who was nearly out the door.

"Where do Igoroes go when they die?" he asked.

The scaly face remained expressionless, but the Igoroe hesitated as if in puzzlement before he answered: "Igoroes dead when dead. Never go anywhere."

"That's all I wanted to know," the Deacon murmured.

"What does it mean?" asked Spud.

The Deacon regarded his companion intently. "It can only mean that they have no belief in an after life," he said at last. "And races who do

not have that belief are invariably Epicureans or debauchees. The Igoroes aren't debauchees; they're nothing but a bunch of home bodies, living life for all they can get out of it with a holy zeal."

"Then Joe must surely be right," exclaimed Spud. "The answer to the question is that the Igoroes would help each other when hurt, apply whatever healing herbs they have—which must be plenty—and be generally good Samaritans."

The Deacon didn't want to have to answer that one, and didn't. He was glancing out the window, and smiled suddenly as a tinny scream shrilled out.

The three went to the window. Beyond the dim, swirling fog three scaled forms were thrashing the mud in a free-for-all. Their needle-toothed jaws gnashed into each other's flesh. Blood spurted into the rain.

It was impossible to see the details of the battle. The fighters rolled far beyond the range of vision before the death cries ended. But the Deacon had seen enough.

IT WAS AFTERNOON when the three Igoroes came again. As if it were part of the ceremony, they carefully laid their hardwood spears on the ground outside. In one palm they held a bowl of clear liquid. Contents of the three bowls were of differing shades of red.

With deference, but yet with firmness and an aura of antagonism, they quickly surrounded Joe.

He went white, and sweat began to stream down his face more rapidly. There was no sound from the hundreds of Igoroes outside.

The shrill piping of the Igoroe burst out. "What must an Igoroe do if he injures or sees an injured Igoroe?"

Joe opened his mouth, but no words came. He looked with agonized pleading at his companions. Spud and the Deacon stood stiffly in opposite corners of the hut.

Then Joe's faltering voice came weakly. "He must help the Igoroe, give him herbs, heal his wounds—"

He almost collapsed. Two of the Igoroes gripped his arms. They held their three bowls in front of him as if he were to take his choice. A whispered scream of despair came from the Igoroes outside.

"Don't—" Spud began.

The Deacon said nothing.

Joe hesitated, until the Igoroes squeezed his arms. He cried out in pain and grasped one of the bowls and downed its contents.

The Igoroes dropped him to the earth, where he lay gasping.

Then the Igoroe piped again. "The second question: If an Igoroe finds the possession that another Igoroe has lost, what must he do? Answer by darkness."

They left. Spud stared unbelievably after them. "The second question! Then Joe must have failed! But what *was* the answer? Where were we wrong?"

The two stared at Joe, who just sat in the water and muck, not moving, his face expressionless.

For what seemed hours, Spud looked at him, then turned his face away. "Whatever poison they fed him, we've got to forget him. It's our necks now! Where were we wrong? Why wasn't that the right answer? What would an Igoroe do if he found another's spear or little tin bowl, or wife, or diamond stick-pin? How can a man think in this heat? Tell me, Deac, what's the answer? You've studied these things, races, psychology. Tell me—"

He stopped. The Deacon was staring at him.

"I must be going looney in this heat," he murmured. Quietly he slumped down in a corner.

The Deacon remained unmoving. His mind was working swiftly over this new problem. He knew he had gauged the last one correctly. Now the question of property—

Spud broke in on him. "Stuff must be scarce around here. They'd grab it off and hide it. Isn't that what they'd do, Deac?"

"You forget we're dealing with a race we decided was very moral according to our own—or rather, Earth standards."

"Sure, and even though they'd really grab it off, they'd expect their god to tell them it wasn't the proper thing to do and to give it up, wouldn't they? That one's easy!"

The Deacon wondered. He thought it was easy, too. It was splitting hairs very fine—the difference between his answer and Spud's. He'd been watching through the window into the grayness ever since the Igoroes' departure, hoping for a clue, but he found no more than what he already knew.

His thoughts were sheared off by the shrill, insane cry that broke from Joe's throat. Their companion had suddenly risen, tearing at his clothes and beating upon his body. "It's burning me up! It's burning me up! Oh, don't let it burn me!"

He flung himself full length in the water on the floor, burying his face in the mud. Spud turned away. It took a lot to make his stomach roll over, but it hadn't been treated very well the last three weeks.

The Deacon continued staring. "He's drowning!"

Joe writhed in terrible pain. Once he raised his head and screamed again. "Don't burn—"

"We can't let him die that way," said the Deacon. He began tearing

at the wall of the hut, and finally jerked away a long pole. Spud had turned back, face white.

"Do you want to, or shall I?" the Deacon asked.

"I will."

Spud raised the heavy pole and brought it down once.

IT WAS NOT dark enough to prevent their seeing each other across the hut when the Igoroes came again. The Deacon watched them lay their spears on the ground so ceremoniously before the door again. He wondered why they carried them.

He held his breath as they entered. It was not yet his turn.

They surrouted Spud and piped the question.

Spud stood stiffly erect, trying to smile at the Deacon. "If an Igoroe finds something belonging to another Igoroe, he gives it back," he said.

The three remained motionless. Spud swallowed nervously. "Or does that hurt your conscience—if any—too much?"

"What does an Igoroe do if he finds another Igoroe's possession?" the lizard repeated.

"Gives it back, I said!" Spud shouted.

The three held out their bowls. Spud bit his lip and stared at them.

Slowly he raised one to his lips and winked at the Deacon. He brought his arm back swiftly and hurled the bowl with all his might into the open jaws of the Igoroe. He leaped backward beyond the reach of the other two, trying to reach the window.

But his foot slipped in the mud and the other two Igoroes were upon him with savage force that was more terrible because of their quietness and determination.

"You will take this one," one of them hissed.

They pinned Spud to the floor and poured the contents of one bowl into his mouth. In spite of his sputtering and blowing, most of it trickled down his throat because two scaled claws wedged between his jaws.

The Igoroes rose and retreated to the door, visibly trembling. There they stood dramatically erect, and one piped the third question: "Can our god die? Answer at light." Then they were gone.

Spud got up, shrugging at the effect of the drink. It seemed mildly intoxicating.

"That's good stuff," he said to the Deacon. "We could sell it for five dollars a pint back on Earth."

His eyes became faraway. "Back on Earth—"

Darkness dropped quickly. Still the mob of Igoroes stamped and



TOPS 'EM ALL!



BIGGER DRINK • BETTER FLAVOR

† Pepsi-Cola is made only by Pepsi-Cola Company, Long Island City, N. Y. Bottled locally by authorized bottlers.

splashed patiently in the endless falling rain.

With darkness, Spud felt his senses slipping from him. He grew cold and afraid inside. He had seen Joe just sitting in his corner, finally rising with those horrible screams. But Spud just couldn't keep awake any longer. He slumped in drowsiness.

The Deacon's mind was working with all the furious intensity and cunning that had successfully carried him through thirty years of living by his wits.

He had been right about the first two questions. Joe and Spud had been stupid not to see that with no belief in an after life, with a high morality and an Epicurean outlook on life, suffering would be the height of the intolerable to the Igoroes. It would not be mercy to heal a wounded Igoroe because they had no science with which to heal him. The answer was to kill him as quickly as possible. That was why those two Igoroes had pounced on one of their companions earlier in the day when he had accidentally stumbled into a spear. But, then, Spud and Joe hadn't seen the accident—

The second question would have been a longer shot if they'd asked him. But Spud had been right about stuff being scarce. It was so scarce that Spud's answer had undoubtedly sounded silly to the Igoroes. Returning a found possession was merely a minor matter. With their Puritanical extremes of morality, the important part was that an Igoroe should, in addition, pay for the great privilege of being able to return it. The Deacon knew this was logical because one of the sand races on Mars had just such a morality concerning possessions. Theft of any kind was punished with death. Among the Igoroes it would proba-

bly be torture, since death was no punishment among them.

The only question in the Deacon's mind was how much the Igoroes considered a finder should pay a loser. He'd have said that he should pay without stipulating any amount and hoped he could get away with it.

But could their god die? Where were the clues to that one? They didn't believe in immortality. Did that apply to their god? The obvious answer was that it didn't. The Deacon was afraid of the obvious.

He racked his brain, frantically searching the dusty catalogue of races he had studied throughout the universe. All he could find was that races who believe in immortality believe in immortal gods. Those who have no belief in after life seldom believe in gods, but the one or two who deny themselves immortality and still have some concept of a nebulous omnipotent presence at least grant it indestructibility.

This slim precedent from known races was the only basis to apply to the unknown. Would it?

Exhausted beyond his endurance, the Deacon sank down against the wall in a daze of half sleep.

FOR a long time, in the middle of the night's blackness, he thought he heard a scraping, sawing sound, but his consciousness just wouldn't rise to meet it. The sound continued for seeming hours, then died, and the Deacon rolled on his back in deep, exhausted sleep.

When he awoke, dim grayness filled the hut. The fog seemed thicker than ever and was plainly visible swirling in the hut. As the Deacon shook his head and looked about, a swift spasm clenched his insides.

He saw what the noise in the night had been.

The body of Spud Agill was sitting upright in a corner. In his hands was his pocketknife. Blood colored the water deeply.

Spud had amputated his toes one by one, then both feet. And one leg had been nearly cut off at the knee before the blood had drained out of him.

His face showed that he had felt every searing pain of the knife—that his brain had been powerless to stop his hand from cutting.

The Deacon felt his mind dim. Blank spots sprang up suddenly in his memory. He groped for a moment for his identity and his location. And there was something terribly important to be done this morning.

Oh, yes. The third question. Could a god die? That was it.

But how could he know? He wasn't a god. None of them were gods. Two of them were dead. He had to be a god or he would die, too.

But if he were a god he couldn't die. He was safe, then. He chuckled to himself.

Outside, the Igoroes, who never seemed to sleep, pressed close. He felt the tenseness that almost radiated from their bodies. They had reason enough to be excited. This was the big day. The day when their god would be enthroned.

He was that god! He would be the head man from now on, and would he show them!

But first he had to pass their test. Silly—having to pass an examination to be a god. He chuckled again.

Then he caught himself. He gritted his teeth. Get hold of yourself, get hold of yourself. There they come. Three anachronistic saurians. Why don't you go back to your own time? A million years ago. You don't belong here.

They came to the door and paused. The Deacon glanced about, panic-stricken for a moment. But there was nothing to worry about. He had the right answer, and after that—

They stood there, solemn, repulsive. Their little bowls were clawed tightly. The hardwood spears lay on the ground.

They, too, were under tremendous nervous strain. This being before them *had* to be their god. The other two had proven devils and had been destroyed. Now—

“Can our god die?”

“No! No!” The Deacon hurled the words from him. His whole body functions then seemed to pause awaiting the Igoroes' reactions.

Even before they retreated with the little bowls he knew he had given the right answer. The Igoroes outside had relaxed with an audible hissing sigh.

He turned to the mangled corpse in the corner and shouted, “I'm god, Spud, don't you hear? I'm god!”

The endless strain was over. Relief and hysteria flooded over him.

But something was wrong. The Igoroes outside were not dispersing in jubilation. Instead, they were pressing even closer, and a new intensity filled the air. A shuffling sound at the door turned the Deacon's head.

Words collapsed on his lips. The three Igoroes were there. Their little bowls were gone and the hardwood spears were not on the ground.

They were clenched tightly in the claws of the reptiles, the dull wood showing redly like old rusted steel.

The Deacon's eyes opened wide, and he screamed just once, even before they were halfway across the hut, because he knew he couldn't pass the final test of the gods.

ELSEWHERE

By Caleb Saunders

The professor and some students were—gone. It was thoroughly impossible, but the answer was found in Time!

Illustrated by Kramer

EXCERPT from the *Evening Standard*:

SOUGHT SAVANT EVADES POLICE

CITY HALL SCANDAL LOOMS

Professor Arthur Frost, wanted by the grand jury for questioning in connection with the mysterious disappearance from his home last Friday evening of four of his students, escaped today from under the noses of a squad of police sent to arrest him. Police Sergeant Izowski, in charge of the arrest, claimed that Frost disappeared from the interior of the Black Maria under conditions which leave the police puzzled. District Attorney Karnes labeled Izowski's story as preposterous and promised the fullest possible investigation—

"But honest, chief, I didn't leave him alone for a second!"

"Nuts!" answered the chief of police. "You claim you put Frost in the wagon, stopped with one foot on the tailboard to write in your notebook, and when you looked up he was gone. D'yuh expect the grand jury to believe that? D'yuh expect me to believe that?"

"Honest, chief," persisted Izowski, "I just stopped to write down—"

"Write down what?"

"Something he said. I said to him, 'Look, doc, why don't you tell us where you hid 'em? You know we're bound to dig 'em up in time.' And he just gives me a funny, faraway look and says, 'Time—ah, time—yes, you could dig them up in time.'

I thought it was an important admission and stops to write it down. But I was standing in the only door he could use to get out of the wagon. You know, I ain't little; I kinda fill up a door."

"That's *all* you do," commented the chief bitterly and unfairly. "Izowski, you were either drunk, or crazy—or somebody got to you. The way you tell it, it's impossible!"

IZOWSKI was honest—nor was he drunk, nor crazy.

Time—time.

Four days earlier, Dr. Frost's class in speculative metaphysics had met as usual for their Friday-evening seminar at the professor's home. Frost was saying, "And why not, may I ask? Why shouldn't time be a fifth, as well as a fourth, dimension?"

Howard Jenkins, hard-headed student of engineering, answered, "No harm in speculating, I suppose, if it amuses you, but the question is meaningless."

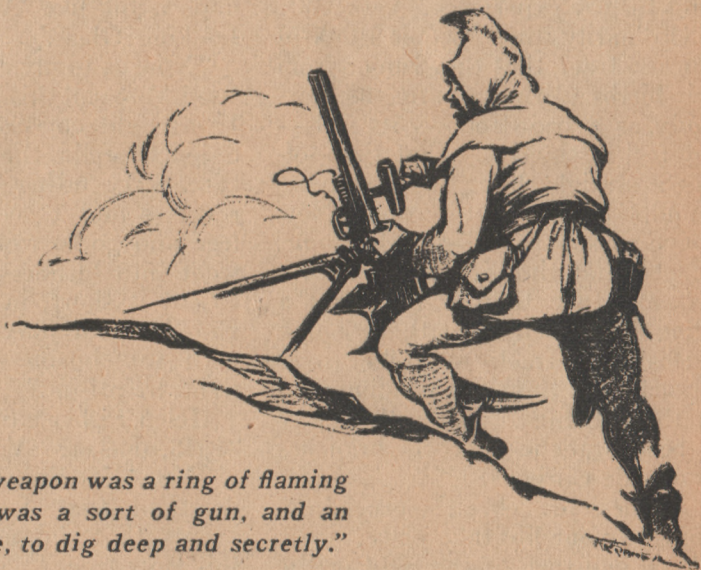
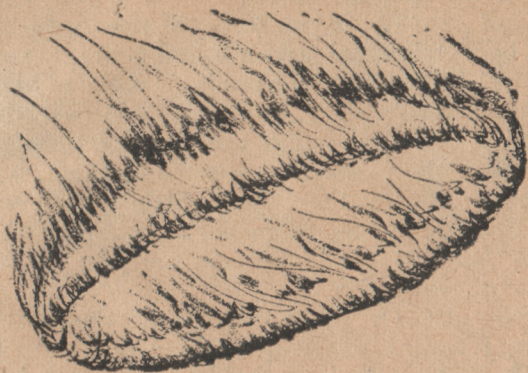
"Why?" Frost's tones were deceptively mild.

"No question is meaningless," interrupted Helen Fisher.

"Oh, yeah? How long is a string?"

"Let him answer," mediated Frost.

"I will," agreed Jenkins. "Human beings are so constituted as to perceive three spatial dimensions and one time dimension. Whether there



"Their main weapon was a ring of flaming energy—our was a sort of gun, and an ability to hide, to dig deep and secretly."

are more of either is meaningless to us, for there is no possible way for us to know—*ever*. Such speculation is a harmless waste of time."

"So?" said Frost. "Ever run across J. W. Dunne's theory of a serial universe with serial time? And he's an engineer, like yourself. And don't forget Ouspensky. He regarded time as multidimensional."

"Just a second, professor," put in Robert Monroe. "I've seen their writings—but I still think Jenkins offered a legitimate objection you

did not answer. How can the question mean anything to human beings if we aren't built to perceive more dimensions? It's like in mathematics—you can invent any system of mathematics you like, on any set of axioms, but a system isn't valid unless it can be used to describe some sort of phenomena. Otherwise it's just so much hot air."

"Fairly put," conceded Frost. "I'll give a fair answer. Scientific belief is based on observation, is it not? Either one's own observations,

or those of a competent, reliable observer. I believe in the existence of a two-dimensional time scheme because I have actually observed it."

The clock ticked on for several seconds.

Jenkins said, "But that is impossible, professor. You aren't built to observe two time dimensions."

"Easy, there," answered Frost. "I am built to perceive them *one at a time*—and so are you. I'll tell you all about it, but before I do so, I must explain the theory of time I was forced to evolve in order to account for my experience.

"Ordinarily, most people think of time as a track that they run on from their births to their deaths, as inexorably as a train follows its rails—they feel instinctively that time follows a straight line, the past lying behind, the future out in front. Now I have reason to believe—to *know*, in fact—that time is analogous to a surface rather than a line, and a rolling, hilly surface, at that. Think of this time track we follow over the surface of time as a winding road cut through hills. Every little way the road branches, and the branches follow side canyons.

"At these branches the crucial decisions of your life take place.

"You can turn to the right or the left into entirely different futures. Occasionally there is a switch-back in the road where one can scramble up or down a bank and skip over a few thousand or million years—if he doesn't have his eyes so fixed on the road that he misses the short cut.

"Once in a while another road crosses at right angles. Neither its past nor its future has any connection whatsoever with the world we know. If you happened to take that turn you might find yourself on another planet in another space-time with nothing left of you or your

world but the continuity of your ego.

"Or, if you have the necessary intellectual strength and courage, you may leave the roads, or paths of high probability, and strike out over the hills of possible time, cutting through the roads as you come to them, following them for a little way, even following them backward, with the past *ahead* of you, and the future *behind* you.

"Or you might roam around the hilltops, doing nothing but the extremely improbable. I can not imagine what that would be like—perhaps a bit like 'Alice Through the Looking Glass.'

"Now as to my evidence—the reason I know all this to be true: When I was eighteen years old I had a decision to make that affected my future. My father suffered financial reverses and I decided to quit college and go to work. Eventually I went into business for myself, and, to cut it short, in 1943 I was convicted of an offense in connection with my business operations and went to prison."

Helen Fisher gave a startled gasp. "1943, doctor? You mean '33?"

"No, Miss Fisher. You must understand that I am speaking of events that did not take place on this time track."

"Oh!" She looked puzzled, but held her peace.

"WHILE in prison I had plenty of time to ponder my mistakes. Prison has a peculiar effect on a man's mind. I drifted farther and farther away from reality, and lived more and more in an introspective world of my own. One night, in a way not then clear to me, my ego left my cell, went back along the time track, and I awoke in my room at my college fraternity house.

"This time I was wiser. Instead

of leaving school, I found part-time work, graduated, and eventually arrived where you now see me."

He paused and glanced at expressions varying from open doubt to fascinated wonder.

"Doctor," asked young Monroe, "can you give us any idea as to what happened—as to how the stunt was done?"

"Yes, I can," Frost assented. "I worked on that problem for many years, trying to recapture the conditions under which it occurred. Recently I have succeeded, and have made several little excursions into possibility."

Estelle Martin, who had kept quiet up to then, leaned forward and spoke in an intense whisper.

"Tell us how, Professor Frost. I must know!"

"The means is very simple. The key lies in convincing the subconscious mind that it can be done—"

"Then the Berkeleyian idealism is proved!"

"In a way, Miss Martin. To one who believes in Bishop Berkeley's philosophy, the infinite possibilities of two-dimensional time offer proof that the mind creates its own world, but a Spencerian determinist, such as our good friend Howard Jenkins, would never leave the road of maximum probability. To him the world would be mechanistic and real.

"But as to the method—I have perfected a technique which will enable others to travel about in the pattern of times as I have done. That is the real reason why these Friday-evening meetings of the seminar have been held in my home—so that when the time came, you all might try it if you wished."

He got up and went to a large cabinet at the far end of the room.

"You mean we could go tonight, doctor?"

"Yes indeed. The process is one of hypnotism and suggestion. Neither are actually necessary, but that is the quickest way of teaching the subconscious to break out of its groove and go where it pleases. I use a revolving ball, or similar device, to tire the conscious mind into a simple hypnosis. During that period the subject listens to a recording which suggests the time road to be followed, whereupon he *does* follow it. It is as simple as that. Do any of you care to try it?"

"Is it likely to be dangerous, doctor?"

He shrugged his shoulders. "The process isn't—just a deep sleep and a phonograph record. But the world of the time track you visit will be just as real as the world of this time track, with equivalent physical hazards—such as prisons! You are all over twenty-one. I am not urging you, I am merely offering you the opportunity."

Monroe stood up. "I'm going, doctor."

"Good! Just sit over here and use these earphones. Anyone else?"

"Count me in." It was Helen Fisher.

Estelle Martin stood and joined them. Howard Jenkins went hastily to her side. "Are *you* going to try this business?"

"Most certainly."

He turned to Frost. "I'm in, doc."

Frost seated them where they could wear the earphones, and then said:

"You will remember the different types of things I said you could do; branch off, go at right angles into a different world, skip over into the past or future, or cut straight through the maze of probable tracks on a path of extreme improbability. I have records for all of those."

Monroe was first again. "I'll take a right-angle turn and a brand-new world."

Estelle did not hesitate. "I want to—how did you put it?—climb up a bank to a higher road somewhere in the future."

"I'll try that, too." It was Jenkins.

"I'll take the remote-possibilities track," put in Helen Fisher.

"That takes care of everybody," commented the professor. "Now—all of these records contain the suggestion for you to return to this room two hours from now, figured along this time track. Put on your ear-phones. The records run thirty minutes. I'll start them and the ball together."

He swung a glittering, many-faceted sphere from a hook in the ceiling, started it whirling, and turned a small spotlight on it. Then he turned off all the other lights and started the records all at once by throwing a master switch. The scintillating ball twirled round and round for many revolutions, slowed and reversed and twirled back again. Dr. Frost turned his eyes away to keep from being fascinated by it. Presently he grew weary, and slipped out into the hall to smoke a cigarette. Half an hour passed, and there came the single note of a gong. He hurried back into the room and switched on the light.

Three of the four figures had disappeared.

The remaining figure was Howard Jenkins, who opened his eyes and blinked at the light. "Well, doctor, I guess it didn't work."

The doctor raised his eyebrows. "No? Take a look around you."

The younger man glanced about him. "Where are the others?"

"Where? Anywhere," replied Frost with a shrug, "and *anywhen*."

Jenkins jerked off his earphones and jumped to his feet. "Doctor, what have you done to Estelle?"

Frost gently disengaged a hand from his sleeve. "I haven't done anything with her, Howard. She's on another time track."

"But I meant to go with her."

"And I tried to send you with her."

"But why didn't I go?"

"I can't say for sure—probably the suggestion wasn't strong enough to overcome your skepticism. But don't be alarmed, son. We expect her back in a couple of hours, you know."

"Don't be alarmed! That's easy to say. I didn't want her to try this damn-fool stunt in the first place, but I knew I couldn't change her mind, so I wanted to go along to look out for her. She's so impractical. But see here, doc—where are their bodies? I thought we would just stay here in the room in a sort of trance."

"Not at all, Jenkins. Apparently you didn't understand me in the least. These other time tracks are perfectly real, as real as this one we are in. Their whole beings have gone off on other tracks, just as if they had turned down a side street off a boulevard."

"But that's impossible—it contradicts the law of conservation of energy!"

"You must recognize a fact when you see one—they are gone. Besides, it doesn't contradict the law; it simply extends it to include the total universe, with its second time dimension."

Jenkins rubbed a hand over his face and pulled at his lower lip. "I suppose so. But in that case, anything can happen to her—she could even be *killed* out there. And I can't do a damn thing about it. Oh, I

wish we had never seen this damned seminar!"

The professor showed no resentment at this remark, but instead placed an arm around his shoulders. "Since you can't help her, why not calm down? Besides, you have no real reason to believe that she is in any danger. She may be, it's true, but we have no data to go on. Why borrow trouble? Let's go out to the kitchen and open a bottle of ale while we wait for them to return." He gently urged him toward the door.

AFTER a couple of glasses of ale and a few cigarettes, Jenkins was somewhat calmed down. The professor made conversation.

"How did you happen to sign up for this course, Howard?"

"It was the only course I could take with Estelle."

"I thought so. I let you take it for reasons of my own. I thought that your hard-headed materialism would hold down some of the loose thinking in such a class. Take Helen Fisher, for example; she is prone to reason brilliantly from insufficient data. You help to keep her down to earth."

"To be frank, Dr. Frost, I could never see the need for all this highfalutin' discussion. I like facts."

"But you engineers are as bad as the metaphysicians—you ignore any fact that you can't weigh in scales. If you can't bite it, it's not real. You believe in a mechanistic, deterministic universe, and ignore the real facts of human consciousness, human will, and human freedom of choice—facts that you have directly experienced!"

"But all these things can be explained in terms of reflexes."

The professor spread his hands. "Why don't you admit that there

are a few things about psychology that you don't understand as yet?" He paused and cocked his head. "Did you hear something?"

"I think I did."

Then they both heard it—a clear contralto voice, "Doctor! Dr. Frost!"

Jenkins whirled around. "That's Estelle!" They ran back to the study, the doctor endeavoring manfully but unsuccessfully to keep up.

But it was not Estelle. Standing in the hallway was Helen Fisher, her sweater torn and dirty, her stockings missing, and a barely healed scar puckering one cheek. Frost stopped and surveyed her, a perturbed look on his face. "Are you all right, child?" he inquired anxiously.

She grinned boyishly. "I'm O. K. You should see the other guy."

"Tell us all about it."

"In a minute. How about a cup of coffee for the prodigal? And I wouldn't turn up my nose at some scrambled eggs and some—lots of—toast. Meals are inclined to be irregular where I've been."

"Yes indeed. Right away," answered Frost, "but where *have* you been?"

"Let a gal eat, please," she begged. "I won't hold out on you. What is Howard looking so sour about?"

The professor whispered a hurried explanation. She gave Jenkins a compassionate glance. "Oh, she hasn't? I thought I'd be last man in. I was away so long. What day is this?"

Frost glanced at his wrist watch. "You're right on time; it's just eleven o'clock."

"The hell you say! Oh, excuse me, doctor. 'Curiouser and curiouser,' said Alice. All in a couple of hours. Just for the record, I was gone several weeks, at least."

WHEN her third cup of coffee had washed down the last of the toast, she consented to begin:

"When I woke I was falling upstairs—through a nightmare, several nightmares. Don't ask me to describe *that*—nobody could. That went on for a week, maybe, then things started to come into focus. I don't know in just what order things happened, but when I first started to notice things clearly I was standing in a little barren valley. It was cold, and the air was thin and acrid. It burned my throat. There were two suns in the sky, one big and reddish, the other smaller and too bright to look at."

"Two suns!" exclaimed Howard. "But that's not possible—binary stars don't have planets."

She favored him with a stare. "Have it your own way—I was *dere*, Sharlie.' Just as I was taking this all in, something whizzed overhead and I ducked. That was the last I saw of that place.

"I slowed down next back on Earth—at least it looked like it—and in a city. It was a big city in a highly evolved technical culture. I was in a trafficway with a lot of fast-moving traffic on it. I stepped out and tried to flag one of the vehicles—a long, crawling caterpillar thing with about fifty wheels—when I caught sight of what was driving it, and dodged back in a hurry. It wasn't a man, and it wasn't an animal, either—not one I've ever seen, or heard of. It wasn't a bird, or a fish, nor an insect. The god that thought up the inhabitants of *that* city doesn't deserve worship. I don't know what they were, but they crawled and they crept and they *stank*. Ugh!" She made a grimace as if trying to eject something unpleasant from her mouth.

"I slunk around holes in that

place," she continued, "for a couple of weeks, before I recovered the trick of jumping the time track. I was pretty desperate, for I thought that the suggestion to return to now hadn't worked. I couldn't find much to eat, and I was lightheaded part of the time. I drank out of what I suspect was their drainage system, but there was nobody to ask, and I didn't really want to know. I was thirsty."

"Did you see any human beings?"

"I'm not sure. I saw some shapes that might have been men squatting around in a circle down in the tunnels under the city, but something frightened them, and they scurried away before I could get close enough to look."

"What else happened there?"

"Nothing much. I found the trick again that same night and got away from there as fast as I could. I am afraid I lost the true scientific spirit, professor—I didn't really care how the 'other half' lived!

"This time I had better luck. I was on Earth again, but in pleasant rolling hills, like the Blue Ridge Mountains. It was summer, and very lovely. I found a little stream and took off my clothes and bathed. It was wonderful. After I had found some ripe berries I lay down in the sun and went to sleep.

"I woke wide awake with a start. Someone was bending over me. It was a man, but no Robert Taylor. He was a Neanderthal. I should have run, but I tried to grab my clothes first, so he grabbed me. I was led back into camp, a Sabine woman, with my new spring sports outfit tucked fetchingly under one arm.

"I wasn't so bad off. It was the Old Man who had found me, and he seemed to regard me as a strange pet, about on a par with the dogs that

snarled around the bone heap, rather than as a member of his harem. I fed well enough, if you aren't fussy—I wasn't fussy after living in the tunnels under that awful city. I even learned to eat slugs and things like that because I was afraid to refuse what the Old Man offered. They aren't really so bad—no worse than raw oysters.

"The Neanderthal isn't a bad fellow at heart—rather good-natured, although inclined to play a little rough. That's how I got this." She fingered the scar on her cheek. "I had about decided to stay quite a while and study them, when one day I made a mistake. It was a rather chilly morning, and I put on my clothes for the first time since I had arrived. One of the young bucks saw me, and I guess it aroused his romantic nature. The Old Man was away at the time and there was no one to stop him.

"He grabbed me before I knew what was happening and tried to show his affection. Have you ever been nuzzled by a caveman, Howard? They have halitosis, not to mention B. O. I was too startled to concentrate on the time trick, or else I would have slipped right out into space-time and left him clutching air.

"I finally showed him a jujitsu trick I learned in Phys. Ed. II, then I ran like hell and skinned up a tree. I counted up to a hundred and tried to be calm. Pretty soon I was shooting upstairs in a nightmare again, and very happy to be doing it."

"THEN you came back here?"

"Not by a whole lot—worse luck! I landed in this present, all right, and apparently along this time dimension, but there was plenty that was wrong with it. I was standing on the south side of Forty-second Street in New York City. I knew

where I was, for the first thing I noticed was the big lighted letters that chase around the Times Building and spell out news flashes. It was running backward, and was hard to read. I was trying to figure out 'DETROIT BEAT TO HITS NINE GET YANKEES' when I saw two cops close to me facing me, but running as hard as they could backward—away from me." Dr. Frost smothered an ejaculation. "What did you say?"

"Reversed entropy—you entered the time track backward—your time arrow was pointing backward."

"Yes, I figured that out later, when I had time to think about it. Just then I was too busy. I was in a clearing in the crowd, but the ring of people was closing in on me, all running backward. The cops disappeared in the crowd, and the crowd ran right up to me, stopped, and started to scream. Just as that happened, the traffic lights changed, cars charged out from both directions, driving backward. The drivers all seemed to be like the Fillyloo Bird that flies backward because he doesn't care where he's going, but he likes to see where he's been.

"It was too much for little Helen. I fainted.

"Following that I seemed to slant at an angle through a lot of places at once—"

"Just a second," Howard interrupted, "just what happened before that? I thought I savvied entropy, but that got me licked."

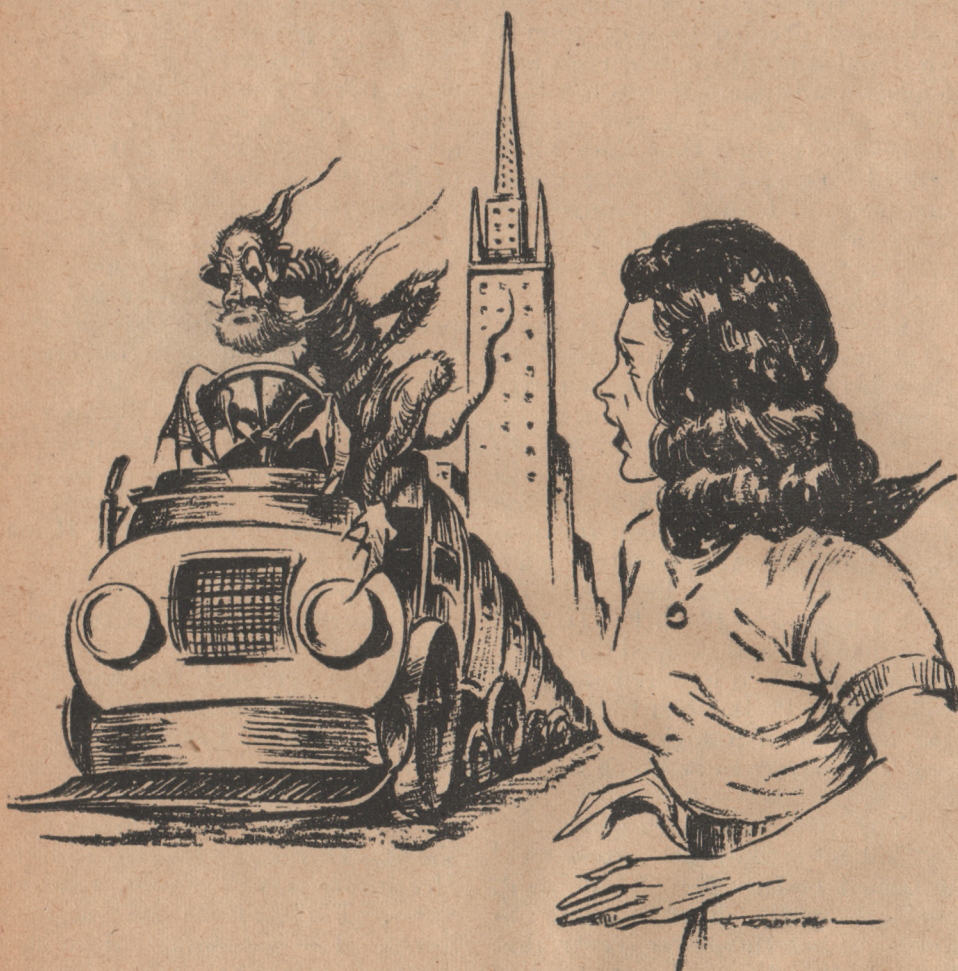
"Well," explained Frost, "the easiest way to explain it is to say that she was traveling backward in time. Her future was their past, and vice versa. I'm glad she got out in a hurry. I'm not sure that human metabolism can be maintained in such conditions.

"Hm-m-m. Go ahead, Helen."

"This slanting through the axis would have been startling if I hadn't been emotionally exhausted already. I sat back and watched it, like a movie. It was surrealist, kind o'—I think Salvador Dali wrote the scenario. I saw landscapes heave and shift like a stormy sea. People melted into plants—I think my own body changed at times, but I can't be sure. Once I found myself in a place that was all insides instead of outsides, like the surface of the

Earth is. Some of the things I saw we'll skip—I don't believe them myself.

"Then I slowed down in a place that must have had an extra spatial dimension. Everything looked three dimensional to me, but they changed their shapes when I *thought* about them. I found I could look inside of solid objects simply by wanting to. When I tired of prying into the intimate secrets of rocks and plants, I took a look at myself, and it worked



"The city I saw seemed fairly normal—till I got a glimpse of the thing driving the truck—

just as well. I know more about anatomy and physiology now than an M. D. It's fun to watch your heart beat—kind o' cute.

"But my appendix was swollen and inflamed. I found I could reach in and touch it—it was tender. I've had some trouble with it, so I decided to perform an emergency operation. I nipped it off with my nails. It didn't hurt at all; bled a couple of drops and closed right up."

"Good heavens, child! You might have gotten peritonitis and died."

"I don't think so. I believe that ultra-violet was pouring all through me and killing the bugs. I had a fever for a while, but I think that what caused it was a bad case of internal sunburn.

"I forgot to mention that I couldn't walk around in this place, for I couldn't seem to touch anything but myself. I sliced right through anything I tried to get a purchase on. Pretty soon I quit trying and relaxed. It was comfortable, and I went into a warm, happy doze, like a hibernating bear.

"After a long time—a long, long time—I went sound asleep and came to in your big easy-chair. That's all."

HELEN ANSWERED Howard's anxious inquiries by telling him that she had seen nothing of Estelle in her travels. "But why don't you calm down and wait? She isn't really overdue yet."

They were interrupted by the opening of the door from the hall. A short wiry figure in a hooded brown tunic and tight brown breeches strode into the room.

"Where's Dr. Frost? Oh— Doctor, I need help!"

It was Monroe, but changed almost beyond recognition. He had been short and slender before, but

was now barely five feet tall, and stocky, with powerful shoulder muscles. In the brown costume with its peaked hood, or helmet, he bore a strong resemblance to the popular notion of a gnome.

Frost hurried to him. "What is it, Robert? How can I help?"

"This first." Monroe hunched forward for inspection his left upper arm. The fabric was tattered and charred, exposing an ugly burn of many square inches. "He just grazed me, but it had better be fixed if I am to save the arm."

Frost examined it without touching it. "We must rush you to a hospital."

"No time. I've got to get back. They need me—and the help I can bring."

The doctor shook his head. "You've got to have treatment for that arm, Bob. Even if there is strong need for you to go back wherever you have been, you are in a different time track now. Time lost here isn't necessarily lost there."

Monroe cut him short. "I think this world and my world have connected time rates. I must hurry."

Helen Fisher placed herself between them. "Let me see that arm, Bob. Hm-m-m—pretty nasty, but I think I can fix it. Professor, put a kettle on the fire with about a cup of water in it. As soon as it boils, chuck in a handful of tea leaves."

She rummaged through the kitchen cutlery drawer, found a pair of shears, and did a neat, almost professional job of cutting away the sleeve and cleaning the burned flesh for dressing. Monroe talked as she worked.

"Howard, I want you to do me a favor. Get a pencil and paper and take down a list. I want a flock of things to take back with me—all of them things that you can pick up at

the fraternity house. You'll have to go for me—I'd be thrown out with my present appearance. What's the matter? Don't you want to do it?"

Helen hurriedly explained Howard's preoccupation. Monroe listened sympathetically. "Oh! Say, that's tough lines, old man." His brow wrinkled in thought. "But look—you can't do Estelle any good by waiting here, and I really do need your help for the next half-hour. Will you do it?"

Jenkins reluctantly agreed. Monroe continued:

"Fine! I do appreciate it. Go to my room first and gather up my reference books on math—also my slide rule. You'll find a limp-leather, India-paper radio manual, too. I want that. And I want your twenty-inch log-log duplex slide rule, as well as my own. You can have my Rabelais and the *Droll Stories*. I want your Mark's 'Mechanical Engineers' Handbook,' and any other technical reference books that you have and I haven't. Take anything you like in exchange.

"Then go up to Stinky Beanfield's room and get his 'Military Engineers' Handbook,' his 'Chemical Warfare,' and his texts on ballistics and ordnance. Yes, and Miller's 'Chemistry of Explosives,' if he has one. If not, pick up one from some other of the R. O. T. C. boys; it's important." Helen was deftly applying a poultice to his arm. He winced a little as the tea leaves, still warm, touched his seared flesh, but went ahead.

"Stinky keeps his service automatic in his upper bureau drawer, along with a target pistol and some other junk. Swipe it, or talk him out of it. Bring as much ammunition as you can find—Colt .45. I'll write out a bill of sale for my car for you to leave for him. Now get

going. I'll tell doc all about it, and he can tell you later. Here. Take my car." He fumbled at his thigh, then looked annoyed. "Heavens! I don't have my keys. I'd forgotten that."

Helen came to the rescue. "Take mine. The keys are in my bag on the hall table."

Howard got up. "O. K., I'll do my damndest. If I get flung in the can, bring me cigarettes." He went out.

HELEN put the finishing touches on the bandages. "There! I think that will do. How does it feel?"

He flexed his arm cautiously. "O. K. It's a neat job, kid. The tannic acid takes the sting out."

"I believe it will heal right up if you keep tannin solution on it. Can you get tea leaves where you are going?"

"Yes, and pure tannic acid, too. I'll be all right. Now you deserve an explanation for your trouble. Professor, do you have a cigarette on you? I could use some of that coffee, too, if there is any left."

"Surely, Robert." Frost hastened to serve him.

Monroe accepted a light and began:

"It's all pretty cockeyed. When I came out of the sleep I found myself, dressed as I am now and looking as I now look, marching down a long, deep fosse. I say marching because I was one of a column of threes in a military detachment. The odd part about it is that I felt perfectly natural. I knew where I was and why I was there—and *who* I was. I don't mean Robert Monroe; my name over there is Igor." Monroe pronounced the guttural deep in his throat and trilled the "r." "I hadn't forgotten Monroe; it was more as if I had suddenly remem-

bered him. I had *one* identity and *two* pasts. There wasn't any conflict in my mind. It was something like waking up from a clearly remembered dream, only the dream was perfectly real. I *knew* Monroe was real, just as I knew Igor was real.

"My world is much like Earth; a bit smaller, but much the same surface gravity. Men like myself are the dominant race, and we are about as civilized as you folks, but our culture has followed a somewhat different course. We live underground about half the time. Our homes are there, and a lot of our industry. You see, it's warm underground in our world, and not entirely dark. There is a mild radioactivity, mostly light and heat, with a few hard rays.

"Nevertheless, we are a surface-evolved race, and can't be healthy nor happy if we stay underground all the time. Now there is a war on, and we've been driven underground for eight or nine Earth months. The war is going against us. As it stands now, we have lost control of the surface, and my race is being reduced to the status of hunted vermin.

"You see, we aren't fighting human beings. I don't know just what it is we are fighting—maybe beings from outer space. We don't know. They attacked us several places at once from great flying rings the like of which we had never seen. They burned us down without warning. Many of us escaped underground, where they haven't followed us. They don't operate at night, either—seem to need sunlight to be active. So it's a stalemate now, or was, until they started gassing our tunnels."

"We've never captured one of them, and consequently don't know what makes them tick. We examined a ring that crashed, but didn't

learn much. There was nothing inside that even vaguely resembled animal life, nor was there anything to support animal life as we know it. I mean there were no food supplies, nor sanitary arrangements. Opinion is about evenly divided between the idea that the enemy is some sort of nonprotoplasmic intelligence, perhaps force patterns, or that the ring we examined was remotely controlled, or something else equally esoteric.

"Our principle weapon is a beam which creates a stasis in the ether and freezes 'em solid. Or rather it should, for it will destroy all life and prevent molar action—but the rings are simply put temporarily out of control. Unless we can keep a beam on a ring right to the moment it crashes, it always recovers and gets away. Then its pals come and burn out our position.

"We've had better luck with mining their surface camps and blowing them up at night. We're accomplished sappers, of course. But we need some more decisive weapon. That's what I sent Howard after. I've got two ideas. If the enemy is simply some sort of intelligent force pattern, or something like that, radio may be the answer. We might be able to fill up the ether with static, for instance, and jam them right out of existence. If they are too tough for that, perhaps some good old-fashioned antiaircraft fire might make them say 'uncle.' In any case, there is a lot of technology here that we don't have, and which may have the answer. I wish I had time to pass on some of our stuff in return for what I'm taking with me."

"You are determined to go back, Robert?"

"Certainly. It's where I belong. I've no family here. I don't know how to make you see it, doc, but

those are my people—that is my world. I suppose if the conditions were reversed, and there was someone I loved enough to be fighting for here, I'd feel differently."

"I see," said Helen, "you're fighting for the wife and kids."

He turned a weary face toward her. "Not exactly. I'm a bachelor over there, but I've a family to think about, all right. My sister is in command of the attack unit I'm in, not to mention my other relatives. Oh, yes, the women are in it—they're little and tough, like you, Helen."

She touched his arm lightly. "How did you pick up this?"

"That burn? You remember we were on the march when I arrived over there. We were retreating down that ditch from an unsuccessful surface raid. I thought we had made good our escape, when all of a sudden a ring swooped down on us. Most of the detachment scattered, but I'm a junior technician armed with the stasis ray. I tried to get my equipment unlimbered and set up to fight back, but I was burned down before I could finish. Luckily it barely grazed me. Several of the others were fried. I don't know yet whether or not sis got hers. That's one of the reasons why I'm in a hurry to get back.

"One of the other technicians who wasn't hit got his gear set up and covered our retreat. I was dragged underground and taken to a dressing station. The medicos were about to work on me when I lost consciousness and came to in the professor's study."

THE FRONT doorbell rang and the professor got up to answer it. Helen and Robert followed him. It was Howard, bearing spoils.

"Did you get everything?" Robert asked anxiously.

"I think so. Stinky was in, but I managed to borrow his books. The gun was a little harder, but I telephoned a friend of mine and had him call back and ask for Stinky. While he was out of the room I lifted the gun. Now I'm a criminal—government property, too."

"You're a real pal, Howard. After you hear the explanation you'll agree that it was worth doing. Won't he, Helen?"

"Absolutely!" She nodded vigorously.

"Well, I hope you're right," he answered dubiously. "I brought along something else, just in case. Here it is." He handed Robert a book.

"'Aerodynamics and Principles of Aircraft Construction,'" Robert read aloud. "How did I forget that? Thanks, Howard."

"One moment, Robert. How do you know that these invaluable books will go with you?"

"Why not? That's why I'm fastening them to me."

"Did your earthly clothing go through the first time?"

"No-o-o—" His brow furrowed and he hesitated. "Good grief, doc, what can I do? I couldn't possibly memorize what I need to know."

"I don't know, son. Let's think about it a bit." Frost broke off and stared at the ceiling. Presently Helen touched his hand.

"Perhaps I can help, professor."

"In what way, Helen?"

"Apparently I don't metamorphize when I change time tracks. I had the same clothes with me everywhere I went. Why couldn't I ferry this stuff over for Bob?"

"Hm-m-m, perhaps you could."

"No, I couldn't let you do that," interposed Monroe, "you might get killed or badly hurt."

"I'll chance it."

"I've got an idea!" put in Jenkins. "Couldn't Dr. Frost set his instructions so that Helen would go over and come right back? How about it, doc?"

"Hm-m-m, yes, perhaps." But Helen held up a hand.

"No good. The boodle might come bouncing right back with me. I'll go over without any return instructions. I like the sound of this world of Bob's anyway. I may stay there. Cut out the chivalry, Bob. One of the things I liked about your world was the notion of treating men and women alike. Get unstuck from that stuff and start hanging it on me. I'm going."

She presented an appearance something like a Christmas tree when the dozen-odd books had been tied to various parts of her solid little figure, the automatic pistol strapped on, and the two slide rules, one long and one short, stuck in the pistol belt.

Howard fondled the large slide rule before he fastened it on. "Take good care of this slipstick, Bob," he said. "I gave up smoking for six months to pay for it."

Frost seated the two youngsters side by side on the sofa in the study. Helen slipped a hand into Bob's. When the shining ball had been made to spin, Frost motioned for Jenkins to leave, closed the door after him, and switched out the light. Then he started repeating hypnotic suggestions in a monotone.

Ten minutes later he felt a slight swish of air and ceased. He snapped the light switch. The sofa was empty, even of books.

FROST AND JENKINS kept an uneasy vigil while awaiting Estelle's return. Jenkins wandered nervously around the study, examining objects that didn't interest him and smoking

countless cigarettes. The professor sat quietly in his easy-chair, simulating a freedom from anxiety that he did not feel. They conversed in a desultory fashion.

"One thing I don't see," observed Jenkins, "is why in the world Helen could go a dozen places and not change, and Bob goes just one place and comes back almost unrecognizable—shorter, heavier, and decked out in outlandish clothes. How do you explain those things, professor?"

"Eh? I don't explain them—I merely observe them. Maybe his clothes underwent a change, too, or perhaps they are floating around somewhere in space-time. I think perhaps he changed, while Helen didn't, because Helen was just a visitor to the places she went to, whereas Monroe belonged over there. Perhaps the Great Architect intended for him to cross over."

"Huh? Good heavens, doctor, surely you don't believe in divine predestination!"

"Perhaps not in those terms. But, Howard, you mechanistic skeptics make me tired. Your naïve ability to believe that things 'jest growed' approaches childishness. According to you, a fortuitous accident of entropy produced Beethoven's Ninth Symphony."

"I think that's a little unfair, doctor. You certainly don't expect a man to believe in things that run contrary to his good sense without offering him any reasonable explanation."

Frost snorted. "I certainly do—if he has observed it with his own eyes and ears, or gets it from a source known to be credible. A fact doesn't have to be understood to be true.

"Now these events tonight, which you are so anxious to rationalize in orthodox terms, furnish a clue to a lot of things that scientists have

been rejecting because they couldn't explain them. Have you ever heard the tale of the man who walked around the horses? No? Well, about 1810, Benjamin Bathurst, British ambassador to Austria, arrived in his carriage at an inn in Perleberg, Germany. He had his valet and secretary with him. They drove into the lighted courtyard of the inn. Bathurst got out and, in the presence of the bystanders and his two attachés, walked around the horses. He hasn't been seen since."

"What happened?"

"Nobody knows. Personally, I think he was preoccupied and inadvertently wandered into another time track. But there are literally hundreds of similar cases."

Howard stopped pacing and pulled at his lower lip. "Maybe so, doctor. I'm too upset to consider the matter. Look here—it's one o'clock. Oughtn't she be back by now?"

"I'm afraid so, son."

"You mean she's not coming back?"

"It doesn't look like it."

The younger man gave a broken cry and collapsed on the sofa. His shoulders heaved convulsively. Presently he calmed down a little. Frost saw his lips move and suspected that he was praying. Then he showed a drawn face to the doctor.

"Isn't there anything we can do?"

Frost waited before replying. "That's hard to answer, Howard. We don't know where she's gone; all we do know is that she left here under hypnotic suggestion to cross over into some other loop of the past or future."

"Can't we go after her the same way and trace her?"

"I don't know. I haven't had any experience with such a job."

"I've got to do something or I'll go nuts."

"Take it easy, son. I'm as anxious to help as you are. Let me think about it." He smoked in silence while Howard relentlessly controlled an impulse to commit some wild action—scream, break furniture, anything!

Frost knocked the ash off his cigar and placed it carefully in a tray. "I can think of one chance. It's a remote one."

"Anything!"

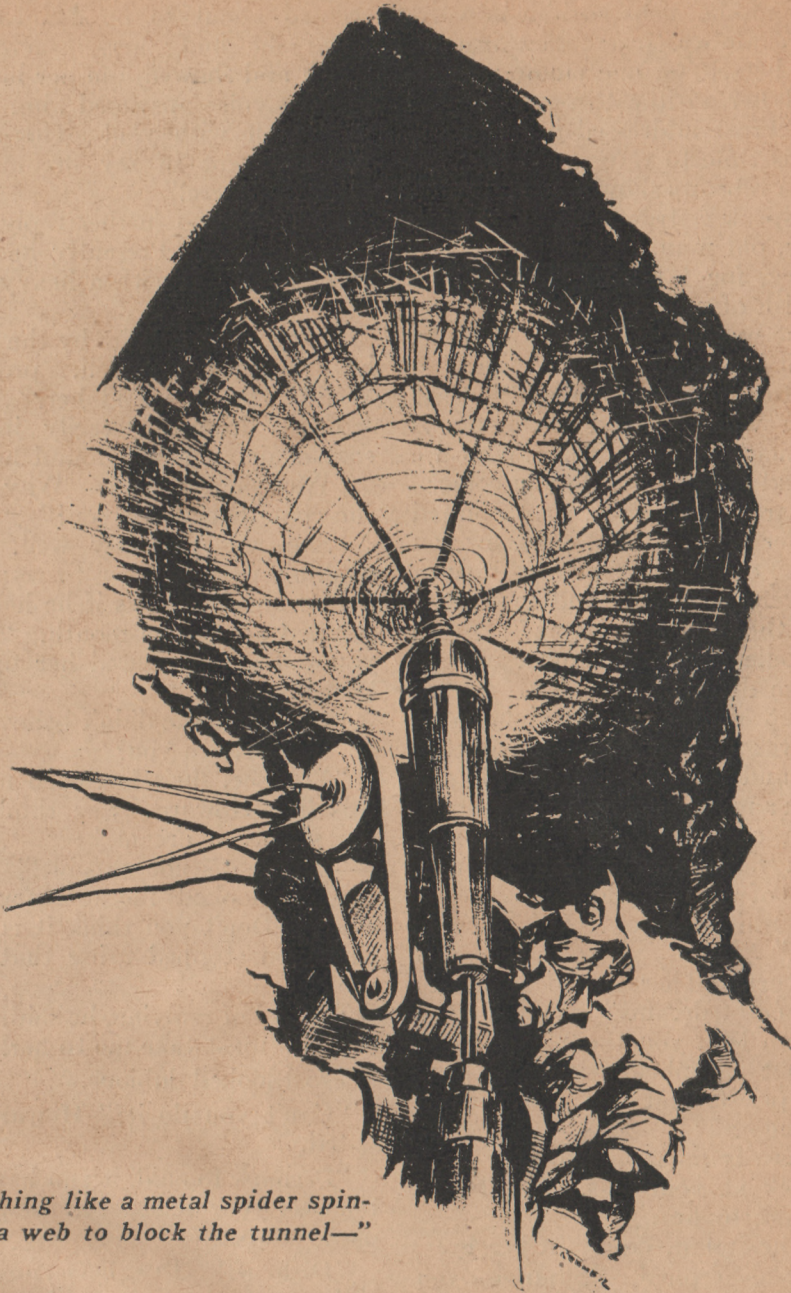
"I'm going to listen to the record Estelle heard, while concentrating on her. Perhaps I can establish some rapport, some extra-sensory connection, that will serve to guide me to her."

Frost went immediately about his preparations as he spoke. "I want you to remain in the room when I go, so that you will really believe it can be done."

Howard watched him don the headphones in silence. The professor stood still, eyes closed. He remained so for nearly fifteen minutes, then took a short step forward. The earphones clattered onto the floor. He was gone.

Frost felt himself drift into the timeless limbo which precedes transition. He noticed again that it was exactly like the floating sensation that ushers in normal sleep, and wondered idly, for the hundredth time, whether or not the dreams of sleep were real experiences. He was inclined to think so. Then he recalled his mission with a guilty start and concentrated hard on Estelle.

He was walking along a road, white in the sunshine. Before him were the gates of a city. The gate-man stared at his odd attire, but let him pass. He hurried down the broad tree-lined avenue which—he knew—led from the space port to Capitol Hill. He turned aside into



“—a thing like a metal spider spinning a web to block the tunnel—”

the Way of the Gods and continued until he reached the Grove of Priestesses. There he found the house which he sought, its marble walls pink in the sun, its fountains tinkling

in the morning breeze. He turned in.

The ancient janitor, nodding in the warmth, admitted him to the house. The slender maidservant,

hardly nubile, ushered him into the inner chamber, where her mistress raised herself on one elbow and regarded her visitor through languid eyes. Frost addressed her:

"It is time to return, Estelle."

Her eyebrows showed her surprise. "You speak a strange and barbarous tongue, old man, and yet, here is a mystery, for I know it. What do you wish of me?"

Frost spoke impatiently. "Estelle, I say it is time to return!"

"Return? What idle talk is this? Return where? And my name is Star Light, not Ess Tell. Who are you, and from where do you come?" She searched his face, then pointed a slender finger at him. "I know you now! You are out of my dreams. You were a master and instructed me in the ancient wisdom."

"Estelle, do you remember a youth in those dreams?"

"That odd name again! Yes, there was a youth. He was sweet—sweet and straight and tall, like a pine on a mountain. I have dreamed of him often." She swung about with a flash of long white limbs. "What of this youth?"

"He waits for you. It is time to return."

"Return! There is no return to the place of dreams!"

"I can lead you there."

"What blasphemy is this? Are you a priest, that you should practice magic?"

"There is no magic to it. He is heartsick at your loss. I will lead you back to him."

She hesitated, doubt in her eyes, then she replied, "Suppose you could; why should I forsake my vows for the cold nothingness of that dream?"

He answered her gently, "What does your heart tell you, Estelle?"

She stared at him, eyes wide, and

seemed about to burst into tears. Then she flung herself across the couch and showed him her back. A muffled voice answered him.

"Be off with you! There is no youth except in my dreams. I'll seek him there!"

She made no further reply to his importunities. Presently he ceased trying and left with a heavy heart.

HOWARD seized him by the arm as he returned. "Well, professor? Well? Did you find her?"

Frost dropped wearily into his easy-chair. "Yes, I found her."

"Was she all right? Why didn't she come back with you?"

"She was perfectly well, but I couldn't persuade her to return."

Howard looked as if he had been slapped across the mouth. "Didn't you tell her I wanted her to come back?"

"I did, but she didn't believe me."

"Not believe you?"

"You see, she's forgotten most of this life, Howard. She thinks you are simply a dream."

"But that's not possible!"

Frost looked more weary than ever. "Don't you think it is about time you stopped using that term, son?"

Instead of replying, he said, "Doctor, you must take me to her!"

Frost looked dubious.

"Can't you do it?" Howard persisted.

"Perhaps I could, if you have gotten over your disbelief in the process used, but still—"

"Disbelief! I've been forced to believe. Let's get busy."

But Frost did not move. "I'm not sure that I agree to it. You see, Howard, conditions are quite different where Estelle has gone. It suits her, but I am not sure that it

would be a kindness to take you through to her."

"Why not? Doesn't she want to see me?"

"Yes—I think she does. I'm sure she would welcome you, but conditions are very different."

"I don't give a damn what the conditions are. Let's go."

Frost got up. "Very well, then. It shall be as you wish."

He seated Jenkins in the easy-chair and held the young man's eye with his gaze. He gripped Jenkins' left wrist and spoke slowly in calm, modulated tones.

Frost assisted Howard to his feet and brushed him off. Howard laughed and wiped the white dust of the road from his hands.

"Quite a tumble, master. I feel as if some lout had pulled a stool from under me."

"I shouldn't have had you sit down."

"I guess not." He pulled a large multiflanged pistol from his belt and examined it. "Lucky the safety catch was set on my blaster, or we might have been picking ourselves out of the stratosphere. Shall we be on our way?"

Frost looked his companion over; helmet, short military kilt, short sword and accouterments slapping at his thighs. He blinked and answered, "Yes. Yes, of course."

As they swung into the city gates, Frost inquired, "Do you know where you are headed?"

"Yes, certainly. To Star Light's villa in the Grove."

"And you know what to expect there?"

"Oh, you mean our discussion. I know the customs here, master, and am quite undismayed, I assure you.

"Star Light and I understand each other. She's one of these 'out of

sight, out of mind' girls. Now that I'm back from Ultima Thule, she'll give up the priesthood and we'll settle down and raise a lot of fat babies."

"Ultima Thule? Do you remember my study?"

"Of course I do—and Robert and Helen and all the rest."

"Is that what you mean by Ultima Thule?"

"Not exactly. I can't explain it, master. I'm a practical military man. I'll leave such things to you priests and teachers."

They paused in front of Estelle's house. "Coming in, master?"

"No, I think not. I must be getting back."

"You know best." Howard clapped him on the shoulder. "You have been a true friend, master. Our first brat shall be named for you."

"Thank you, Howard. Good-by, and good luck to both of you."

"And to you." He entered the house with an easy, confident stride.

Frost walked slowly back toward the gates, his mind preoccupied with a myriad thoughts. There seemed to be no end to the permutations and combinations, either of matter or of mind. Robert, Helen—now Howard and Estelle. It should be possible to derive a theory that would cover them all—

As he mused, his heel caught on a loose paving block and he stumbled across his easy-chair.

THE ABSENCE of the four students was going to be hard to explain, Frost knew—so he said nothing to anyone. The week end passed before anyone took the absences seriously. On Monday a policeman came to his house, asking questions.

His answers were not illuminating, for he had reasonably refrained from trying to tell the true story. The

district attorney smelled a serious crime—kidnaping, perhaps, or a mass murder.

He caused a warrant to be issued Tuesday morning; Sergeant Izowski was sent to pick him up.

The professor came quietly enough and entered the station wagon without protest. "Look, doc," said the sergeant, encouraged by the docile manner of his prisoner, "why don't you tell us where you hid 'em? You know we're bound to dig them up in time."

Frost turned, looked him straight in the eyes, and smiled. "Time," he said softly. "Ah, time—yes, you could dig them up in time." He then went on into the wagon and sat down quietly, closed his eyes and placed his mind in the necessary calm receptive condition.

The sergeant placed one foot on the tailboard, braced his broad bulk in the only door, and drew out his notebook. When he finished writing he looked up, preparatory to locking the door.

Professor Frost was gone.

Frost had intended to look up Howard and Estelle. Inadvertently he let his mind dwell on Helen and Robert at the crucial moment. When he "landed," it was not in the world of the future he had visited twice before. He did not know where he was—on Earth, apparently, somewhere and *somewhen*.

It was wooded rolling country, like the hills of southern Missouri, or New Jersey. Frost had not sufficient knowledge of botany to be able to tell whether the species of trees he saw around him were familiar or not. But he was given no time to study the matter.

He heard a shout, an answering shout. Human figures came bursting out of the trees in a ragged line.

He thought that they were attacking him, looked wildly around for shelter, and found none. But they kept on past him, ignoring him, except that the one who passed closest to him checked his flight, glanced at him hastily, and shouted something. Then he, too, was gone.

Frost was left standing, bewildered, in the small natural clearing in which he had landed.

Before he had had time to integrate these events in his mind one of the fleeing figures reappeared from the direction in which the group had vanished and yelled to him, accompanying the words with a gesture unmistakable—he was to come along.

Frost hesitated in complying. The figure ran toward and hit him with a clean tackle. The next few seconds were very confused to Frost, but he pulled himself together sufficiently to realize that he was seeing the world upside down; the stranger was carrying him at a strong dog-trot, thrown over one shoulder.

Bushes whipped at his face, then the way led downward for several yards, and he was dumped casually to the ground. He sat up and rubbed himself.

He found himself in a tunnel which ran upward to daylight and downward the Lord knew where. Figures milled around him but ignored him. Two of them were setting up some sort of apparatus between the group and the mouth of the tunnel. They worked with extreme urgency, completing what they were doing in a few seconds, and stepped back. Frost heard a soft, gentle hum.

The mouth of the tunnel seemed to become slightly cloudy. He soon saw why—the apparatus, like some giant spider, was spinning a web from wall to wall, blocking the exit to the surface. The web became less

tenuous, translucent, opaque. The hum persisted for many minutes thereafter, and the strange machine continued to weave and thicken the web. One of the figures glanced at its belt, spoke one word in the tones of command, and the humming ceased.

Frost could feel relief spreading over the group like a warm glow. He felt it himself and relaxed, knowing intuitively that some acute danger had been averted.

The member of the group who had given the order to shut off the machine turned around, happened to see Frost, and approached him, asking some question in a sweet but peremptory soprano. Frost was suddenly aware of three things: The leader was a woman, it was the leader who had rescued him, and the costume and general appearance of these people *matched that of the transformed Robert Monroe*.

A smile spread over his face. Everything was going to be all right!

THE QUESTION was repeated with marked impatience. Frost felt that some sort of an answer was required, though he did not understand the language and was sure that she could not possibly know English. Nevertheless—

"Madame," finally he said in English, getting to his feet and giving her a courtly bow, "I do not know your language and do not understand your question, but I suspect that you have saved my life. I am grateful."

She seemed puzzled and somewhat annoyed at his answer and demanded something else—at least Frost thought it was a different question; he could not be sure. This was getting nowhere fast. The language difficulty was almost insuperable, he realized. It might take days, weeks, months to overcome it. In the mean-

time, these people were busy with a war, and would be in no frame of mind to bother with a useless incoherent stranger.

He did not want to be turned out on the surface.

How annoying, he thought, how stupidly annoying! Probably Monroe and Helen were somewhere around, but he could die of old age and never find them. They might be anywhere on the planet. How would an American, dumped down in Tibet, make himself understood if his only possible interpreter were in South America? Or whereabouts unknown? How would he make the Tibetans understand that there even was an interpreter? Botheration!

Still, he must make some sort of a try. What was it Monroe had said his name was *here*? Egan—no, Igor. That was it—Igor.

"Igor," he said.

The leader cocked her head. "Igor?" she said.

Frost nodded vigorously. "Igor."

She turned and called out, "Igor!" giving it the same marked guttural, the same liquid "r" that Monroe had given it. A man pushed through the circle that had gathered around the leader and Frost. The professor looked eagerly at him, but he was a stranger, like the rest. The leader pointed to the man and stated, "Igor."

This is growing complicated, thought Frost; apparently Igor is a common name here—too common. Then he had a sudden idea:

If Monroe and Helen got through, their badly needed chattels might have made them prominent. "Igor," he said, "Helen Fisher."

The leader was attentive at once, her face alive. "'Elen Feesher?" she repeated.

"Yes, yes—Helen Fisher."

She stood quiet for a moment, thinking. It was plain that the words meant something to her. She clapped her hands together and spoke commandingly. Two men stepped forward. She addressed them rapidly for several minutes.

The two men stepped up to Frost, each taking an arm. They started to lead him away. Frost held back for a moment and said over his shoulder, "Helen Fisher?"

"Elen Feesher," the leader assured him. He had to be content with that.

TWO HOURS later, more or less, Frost was not so sure. He had not been mistreated, and the room in which they had placed him was comfortable enough, but it was a cell—at least, the door was fastened. Perhaps he had said the wrong thing, perhaps those syllables meant something quite different here from a simple proper name.

The room in which he found himself was bare, and lighted only by a dim glow from the walls, as had been all of this underground world which he had seen so far. He was growing quite tired of the place and was wondering whether or not it would do any good to set up a commotion when he heard someone at the door.

The door slid back; he saw the leader, a smile on her rather grim, middle-aged features. She spoke in her own tongue, then added, "Igor—Ellenfeesher."

He followed her.

Glowing passageways, busy squares where he was subjected to curious stares, an elevator which startled him by dropping suddenly when he was not aware that it *was* an elevator, and finally a capsulelike vehicle in which they were sealed air-tight, and which went somewhere very fast indeed, to judge by the

sudden surge of weight when it started and again when it stopped—through them all he followed his guide, not understanding and lacking means of inquiring. He tried to let his mind relax and to enjoy the passing moment, as his companion seemed to bear him no ill will, though her manner was brusque—that of a person accustomed to giving orders and not in the habit of encouraging casual intimacy.

They arrived at a door which she opened and strode in. Frost followed and was almost knocked off his feet by a figure which charged into him and grasped him with both arms. "Doctor! Dr. Frost!"

It was Helen Fisher, dressed in the costume worn by both sexes here. Behind her stood Robert—or Igor—his gnomelike face widened with a grin.

He detached Helen's arms gently. "My dear," he said inanely, "imagine finding you here."

"Imagine finding *you* here," she retorted. "Why, professor—you're crying!"

"Oh, no; not at all," he said hastily, and turned to Monroe. "It's good to see you, too, Robert."

"That goes double for me, doc," Monroe agreed.

The leader said something to Monroe. He answered her rapidly in their tongue, and turned to Frost. "Doctor, this is my elder sister, Margri, Actoon Margri—Major Margri, you might translate it roughly."

"She has been very kind to me," said Frost, and bowed to her, acknowledging the introduction. Margri clapped her hands smartly together at the waist and ducked her head, features impassive.

"She gave the salute of equals," explained Robert-Igor. "I translated the title doctor as best I could, which causes her to assume that your

rank is the same as hers."

"What should I do?"

"Return it."

Frost did so as best he might, but awkwardly.

DR. FROST brought his two erst-while students up to "date"—using a term which does not apply, since they were now on a different time axis. His predicament with the civil authorities brought a cry of dismay from Helen. "Why, you poor thing! How awful of them!"

"Oh, I wouldn't say so," protested Frost. "It was reasonable, so far as they knew. But I'm afraid I can't go back."

"You don't need to," Igor assured him. "You're more than welcome here."

"Perhaps I can help out in your war."

"Perhaps—but you've already done more than anyone here by what you've enabled me to do. We are working on it now." He swung his arm in a gesture which took in the whole room.

Igor, it was explained, had been detached from combat duty and assigned to staff work in order to make available Earth techniques. Helen was helping him. "Nobody believes my story but my sister," he admitted, "but I've been able to show them enough for them to realize that what I've got is important, so they've given me a free hand and are practically hanging over my shoulder, waiting to see what we can produce. I've already got them started on a pursuit plane and a 37-millimeter semiautomatic gun to arm it."

Frost expressed surprise. How could so much be done so fast? Were the time rates different? Had Helen and Igor crossed over many weeks before, figured along this axis?

No, he was told, but Igor's countrymen, though lacking many Earth techniques, were far ahead of Earth in manufacturing skill. They used



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a single general type of machine to manufacture almost anything. They fed into it a plan which Igor called, for want of a better term, the blueprints. It was, in fact, a careful scale model of the device to be manufactured; the machine retooled itself and produced the artifact. A three-dimensional pantograph, Igor called the machine, vaguely and inaccurately. One of them was, at that moment, molding the bodies of fighting planes out of plastic, all in one piece and in one operation.

Igor's engineering colleagues had rejected the Earth-type reciprocating engines as being too complex and too inefficient, and had substituted a modified gas engine of their own design which worked on the reaction principle, using a blast of gas as in a turbine. It had no moving parts.

"We are going to arm these jobs with both the stasis ray and the one-pounders," said Igor. "Freeze 'em and then shoot the damn things down while they are out of control."

They talked a few minutes longer, but Frost could see that Igor was getting fidgety. He guessed the reason, and asked to be excused. Igor seized on the suggestion. "We will see you a little later," he said with marked relief. "I'll have some one dig up some quarters for you. We *are* pretty rushed. War work—I know you'll understand."

Frost fell asleep that night planning how he could help his two young friends, and their friends, in their struggle.

BUT it did not work out that way. His education had been largely academic rather than practical; he soon discovered that the reference books which Igor and Helen had brought along were so much Greek to him—worse than that; he understood Greek. He was accorded all honor

and a comfortable living because of Igor's affirmation that he had been the indispensable agent whereby this planet had received the invaluable new weapons, but he soon realized that for the job at hand he was useless, not even fit to act as an interpreter.

He was just a harmless nuisance, a pensioner—and he knew it.

And the underground life was getting on his nerves. The ever-present light bothered him. He had an unallocated fear of radioactivity, born of ignorance, and Igor's reassurances did not stifle the fear. The war depressed him. He was not temperamentally cut out to stand up under the nervous tension of war. His helplessness to aid in the war effort, his lack of companionship, and his idleness, all worked to increase his malaise.

He wandered into Igor and Helen's workroom one day, hoping for a moment's chat if they were not too busy. They were not. Igor was pacing up and down; Helen followed him with worried eyes.

Frost cleared his throat. "Uh—I say, something the matter?"

Igor nodded, answered, "Quite a lot," and dropped back into his pre-occupation.

"It's like this," said Helen. "In spite of the new weapons, things are still going against us. Igor is trying to figure out what to try next."

"Oh, I see. Sorry." He started to leave.

"Don't go. Sit down." He did so, and started mulling the matter over in his mind. It was annoying, very annoying!

"I am afraid I'm not very much use to you," he said at last to Helen. "Too bad Howard Jenkins isn't here."

"I don't suppose it matters," she

answered. "We have the cream of modern Earth engineering in these books."

"I don't mean that. I mean Howard, as he is where he's gone. They had a little gadget there in the future called a blaster. I gathered that it was a very powerful weapon indeed."

Igor caught some of this and whirled around. "What was it? How did it work?"

"Why, really," said Frost, "I can't say. I'm not up on such things, you know. I gathered that it was sort of a disintegrating ray."

"Can you sketch it? Think, man, think!"

Frost tried. Presently he stopped and said, "I'm afraid this isn't any good. I don't remember clearly, and anyhow, I don't know anything about the inside of it."

Igor sighed, sat down and ran his hand through his hair.

After some minutes of gloomy silence, Helen said, "Couldn't we go get it?"

"Eh? How's that? How would you find him?"

"Could you find him, professor?"

Frost sat up. "I don't know," he said slowly, "but I'll try!"

THERE WAS the city. Yes, and there was the same gate he had passed through twice before. He hurried on.

Star Light was glad to see him, but not particularly surprised. Frost wondered if anything could surprise this dreamy girl. But Howard more than made up for her lack of enthusiasm. He pounded Frost's back hard enough to cause pleurisy. "Welcome home, master! Welcome home! I didn't know whether or not you would ever come, but we are ready for you. I had a room built

for you, and you alone, in case you ever showed up. What do you think of that? You are to live with us, you know. No sense in ever going back to that grubby school."

Frost thanked him, but added, "I came on business. I need your help urgently."

"You do? Well, tell me, man; tell me!"

Frost explained. "So you see, I've got to take the secret of your blaster back to them. They need it. They must have it."

"And they shall have it," agreed Howard.

Some time later the problem looked more complicated. Try as he would, Frost was simply not able to soak up the technical knowledge necessary to be able to take the secret back. The pedagogical problem presented was as great as if an untutored savage were to be asked to comprehend radio engineering sufficiently to explain to engineers unfamiliar with radio how to build a major radio station. And Frost was by no means sure that he could take a blaster with him through the country of time.

"Well," said Howard at last, "I shall simply have to go with you."

Star Light, who had listened quietly, showed her first acute interest. "Darling! You must not—"

"Stop it!" said Howard, his chin set stubbornly. "This is a matter of obligation and duty. You keep out of it."

Frost felt the acute embarrassment one always feels when forced to overhear a husband and wife having a difference of opinion.

When they were ready, Frost took Howard by the wrist. "Look me in the eyes," he said. "You remember how we did it before?"

Howard was trembling. "I re-

member. Master, do you think you can do it—and not lose me?”

“I hope so,” said Frost; “now relax.”

THEY GOT BACK to the chamber from which Frost had started, a circumstance which Frost greeted with relief. It would have been awkward to have to cross half a planet to find his friends. He was not sure yet just how the spatial dimensions fitted into the time dimensions. Some day he would have to study the matter, work out an hypothesis and try to check it.

Igor and Howard wasted little time on social amenities. They were deep into engineering matters before Helen had finished greeting the professor.

At long last— “There,” said Howard, “I guess that covers everything. I’ll leave my blaster for a model. Any more questions?”

“No,” said Igor, “I understand it, and I’ve got every word you’ve said recorded. I wonder if you know what this means to us, old man? It unquestionably will win the war for us.”

“I can guess,” said Howard. “This little gadget is the mainstay of our system-wide pax. Ready, doctor? I’m getting kinda anxious.”

“But you’re not going, doctor?” cried Helen. It was both a question and a protest.

“I’ve got to guide him back,” said Frost.

“Yes,” Howard confirmed, “but he

is staying to live with us. Aren’t you, master?”

“Oh, no!” It was Helen again.

Igor put an arm around her. “Don’t coax him,” he told her. “You know he has not been happy here. I gather that Howard’s home would suit him better. If so, he’s earned it.”

Helen thought about it, then came up to Frost, placed both hands on his shoulders, and kissed him, standing on tiptoe to do so. “Good-by, doc,” she said in a choky voice, “or anyhow, *au revoir!*”

He reached up and patted one of her hands.

FROST lay in the sun, letting the rays soak into his old bones. It was certainly pleasant here. He missed Helen and Igor a little, but he suspected that they did not really miss him. And life with Howard and Star Light was more to his liking. Officially, he was tutor to their children, if and when. Actually, he was just as lazy and useless as he had always wanted to be, with time on his hands. Time—time.

There was just one thing that he would have liked to have known: What did Sergeant Izowski say when he looked up and saw that the police wagon was empty? Probably thought it was impossible.

It did not matter. He was too lazy and sleepy to care. Time enough for a little nap before lunch. Time enough—

Time.

THE END.



WE'RE NOT ALL HUMAN!

By John W. Campbell, Jr.

An article of speculation based on the known facts of modern mutation of human beings. Mutation is taking place today—both good and bad. The bad we recognize; the good—

ONE difference between the average science-fictionist and the average reader in general is his mental concept of evolution. It seems to work this way; Mr. Average General Reader thinks of evolution as the process whereby nature perfected animals till she achieved man. The science-fictionist is somewhat more willing to call it, mentally, the process whereby nature perfects animals—including man.

That implies that man either will be, or is being, worked on, that superior types will be developed—and raises the delicate question of whether we are all human. If man *is being* worked over, then there will be the usual symptoms of nature's evolutionary laboratory processes—mutants, variations from the norm of the species.

Man's fragile little ego tends to make really thorough investigations of that subject somewhat touchy. The strong protest that "I'm just as good as the next guy" generally rises from a deep and unalterable conviction that the speaker is not anywhere near as "good as the next guy," and doesn't want anybody to find it out. He has, in consequence, no desire whatever to have scientifically exact evidence worked up to prove that he not only is not "as good" as his neighbor, but a lot below the type that will be average in the future.

There's another factor. Evolution and mutation require that the off-

spring do not inherit exactly the characteristics of their parents. The children, in other words, are not "chips off the old block"—they not only are not true, genetic children of their parents any more than the neighbor's children are, they aren't as much so! They belong to a slightly altered species, a not-quite-human species.

Medical and genetic authorities have been interested in that subject for a number of years, naturally. The general public—who object still, somewhat, to the ego-deflating concept of descent from an apelike forebear—is more than disinterested. It would prefer not to consider the matter too closely.

Present human nature is a highly unsatisfactory combination of mulish obstinacy and monkey tendency to hunt each other in packs. A change to the better is (a) very possible, and (b) highly desirable. A change for the worse is possible, but, all things considered, not too easy to conceive. You can't change human nature, unfortunately; that seems to be bred in the beast. But you can change the race; *that is happening right now.*

What evidence of change is there?

FIRST, some conception of the type of data to look for is essential to finding it. Specifically, what we want to find is evidence of human mutation—changes of heredity tending to-

ward different types of human beings.

Evolution has—and therefore it's fair to assume does—progressed by trial and error. Van Vogt, in "Slan," was right in saying nature tries new-changed forms over and over again, never just once. Suppose a laboratory technician were attempting a biological experiment. A single trial might well—and usually could be expected to—give fluky results. The technician would take several dozen guinea pigs, try his experiment on one group of a dozen or so, try a variation on another dozen, and a third variation on a third dozen. Another group would be left unchanged for comparison.

Suppose nature created a mutant form of human with a highly desirable increase in quickness of mind—a mind that could make decisions in a tenth of the time modern man needs. When two years old, nature's single, untested specimen might quite well get in the way of a truck, have a mass of ice fall off a roof on its superior head, or break its neck falling down the stairs. The test comes to the conclusion: Subject died early. Survival value of new type very low. Actually, nature must, to get a test, try several thousand examples of each change.

Nature's been working on the same method for some two and a half billion years. As might be expected, all animals now extant have been so designed as to make that type of multiple-trial experiment simple. The characteristics of the adult animal are determined by the structure of the germ tissue from which it develops, by the way the genes and chromosomes of the egg cell were arranged. The genes serve as the blueprints for the finished animal. When nature makes an alteration in those blueprints, the animal

is altered and, further and more important, all its descendants are altered in the same way.

But generally, the gene structure will have certain characteristic weaknesses, points where it can be changed most readily. In actual fact—and not symbolic or allegorical language—the multiple-experiment trial and error of evolution arises from that circumstance. The gene structure of the old species tends to alter at certain points, and tends to alter most easily in a certain characteristic way. The result is a series of mutants all having the same alteration.

Usually, at any given moment in the history of a race, there are several hundred or thousand different types of mutations which may take place fairly readily. The result is—allegorically speaking—that nature appears as a sloppy technician, allowing her various simultaneous experiments on several different lines to cross-breed and mingle indiscriminately. That makes finding the results of her meddling somewhat more difficult, but also suggests pitfalls for the investigator to watch for.

Another point to consider in our search for evidence of mutation in man is that you don't hear from the satisfied customers. Since the whole process is a trial-and-error proceeding, the successes are going to go quietly about their business, usually quite unaware that they are experiments, and successful experiments. That suggests that if we find any respectable amount of evidence, it will nearly all show that the race is running down, that bad breeding stock is being produced to make worse an already none-too-good race. The errors will have something to yell about, since they *are* errors, and will generally be very unpleasant about it.

ONE THING works against that trial-and-error proceeding. There is only one direction of flight that will make the bullet hit the bull's-eye, but an almost infinite number that won't. For every way of doing a thing, there are, similarly, thousands of ways of *not* doing the thing—including evolving a better form of man.

Nature has a check on that, though. If the bullet is off the target altogether, it doesn't count at all; if it hits the outer edges instead of the bull's-eye it gets a very low score. In evolution, if the new type is a very complete error, a total miss, it doesn't count at all either. It never gets born. The worst errors prove to be nonviable, and are cast away before developing very far. Bad mistakes that aren't quite as severe as those tend to die very young, long before contaminating the race. If they aren't too far off, if they hit the edges of the target, so to speak, they may live themselves—but will not be able to obtain mates, which, from the race viewpoint, amounts to the same thing as immediate death.

These considerations suggest that our best evidence on human mutation will be in hospitals, sanitariums, and State institutions for the defective. We'll see only the errors, because the successes will never appear there. That's why they are successes.

We won't spot more than the tiniest fraction of successes by physical appearance. Six-fingered hands represent one type of successful but unimportant mutation that can be detected; it happens to involve a visible body structure. Most mutations, the really important ones, will involve a change in the metabolism of tissue cells, a different organization of neuro-muscular co-ordination, a new and better type of intercell ac-

tion in brain tissue, or some shift of that order.

Cancer, for instance, could be eliminated from the race by a slight change in the characteristics of cell metabolism, producing a variety of human being that was totally immune to cancer. That would be a highly successful mutation—and an absolutely undetectable one. It would never bring its bearers to hospitals, and no possible test could tell an examining technician that here was a man whose more finely organized tissues could not develop the cell madness known as cancer.

Most mutations are confined to one thing at a time. It is perfectly possible that the mutation producing cancer immunity happened also, by pure coincidence, to produce orange eyes. The probability is remote; short of some such fortuitous linkage of two fundamentally unrelated characteristics, mutations won't show physically. A man with an intelligence quotient of four hundred or so instead of the normal one hundred would need no larger brain—he'd simply need better organization of the tissue present-day man has, plus a slightly greater degree of convolution of the brain surface. Van Vogt's tendrillless Slan represented a perfectly credible picture of a superman immensely different in every organization beneath the skin—yet undetectable from outside.

In that connection: a recent newspaper item reported the death of a man of about eighty who had never been sick a day of his life. He died of heart failure while pitching hay somewhere in the Midwest. Finally in the hands of a doctor—the satisfied customer never has reason to complain—it was discovered that he had gone through life with two complete and functioning hearts.

There was an instance of a major

physical alteration of type—one easy to detect by a reasonably close examination—that was found only by accident after a long life. He'd never had to go to a doctor; why should he? If the alteration had been an improved, clearer, more swiftly functioning mind, he'd never have gotten into the hands of a psychiatrist capable of detecting it; why should he? But if the alteration had produced a poorer type of mind, one tending to blockages, he'd have shown up, all right. He'd have been driven insane by inability to make decisions. The psychiatrist would have spotted that one.

WHAT HAVE the researchers in human mutation detected—and, more interesting, *how many mutants are born?* How fast is our race being altered?

There are over one hundred different pathological conditions—they can't be called diseases—which are well recognized as representing errors of the trial-and-error process of evolution. Bad mutants. Some are quite rare, some comparatively common.

To be classified as a mutation, and not merely an abnormality, a freak birth caused perhaps by mechanical or chemical injury to the developing embryo, the change of form must be inheritable, but not inherited. That is, for complete proof, at least a few cases of the fault must be found in which: 1. The patient shows the characteristic symptoms of the condition. 2. There is no record of this fault in the ancestry for several generations back—the more the better—and at least two or three generations must be proven. 3. The patient marries, has children, and the children show inheritance of the condition.

Some conditions strongly sus-

pected as mutants cannot be proven so because the sufferers never are capable of mating. The mutation is too powerfully unfavorable.

The conditions necessary for proof of mutation are stringently limiting; we will find only the sour notes. And yet—

One of the most famous of all bad mutations is hemophilia. *All the true hemophilia in the world today is directly traceable to mutants.* Consider the chances of a victim of this "bleeder's disease"—a man so subject to hemorrhage that the greatest efforts of modern medicine can barely keep him living—in the world of 1200 A. D. He wouldn't have lived a dozen years. Hemophilia has been very carefully and very thoroughly investigated. Its exact cause in the gene structure has been determined, and its effects to the germ tissue is very well worked out.

On the sufferer, the results are even better known. Even when the victim does not die of hemorrhage, he is crippled by arthritis. Slow leakage from tiny capillaries in the joints gradually paralyzes his knees, ankles, all his limbs. Frequently the sufferer is sterile. Usually, hemophilia, like many another error mutant, wipes itself out within three generations.

Perhaps nature is trying to develop a better form of blood—one that will prevent the deposition of calcium in the arteries with consequent hardening of the arteries and death by stroke or heart failure.

She might work on cancer, too, developing that tumor-proof tissue, where cell anarchy is impossible. Successes, of course, we wouldn't find, but the failures—What would they be like? Tremendously susceptible to cancer, to every and all forms of tumor conditions.

That's known, too. Most of the

cases known are the original mutants; they don't ordinarily live long enough to produce children in turn. Only because occasional cases are so mild—the mutation almost buried under more favorable, counteracting genes—that a fairly normal life is possible have scientists been able to determine that it is a true, heritable condition.

The mildest cases, those capable of a reasonably normal life, simply show the symptoms of epilepsy. The average case is feeble-minded, usually blind, deaf, or both, and dies of tumor of the brain, liver or heart before adolescence. The skin, heart, every organ is subject to tumors, and it is tumor of one vital organ or another that causes death. An average severe case dies before reaching two years, blind, deaf, almost mindless because of tumors of the brain.

When the trial and error produces errors, they can be terribly tragic errors. Most of the bad mutation results are less severe, but a large percentage of them lead to very real and very bitter tragedies to the individual. For they are clearly, by their very nature, beyond hope of cure; it is as hopeless to seek a cure for them as to seek a "cure" for the human characteristic of producing red blood instead of the blue copper-based blood of the lobster. Such "errors" are not truly distorted human beings; they are properly developed unhuman beings.

THE CATALOGUE of detectable and detected variations from the human type is long, and—because only the dissatisfied customer complains—tends to be unhappy. Some are mutations without much effect, but which are detectable, and hence listed. There is one mutation known which produced a piebald human, with skin varicolored in patches as

is common enough in other mammals, but happens to be unusual in man. The six-fingered hand is another unimportant but discoverable mutation. A fully developed mutation to six fingers, incidentally, is not to be considered a deformity in the slightest degree. The resultant hand is perfectly formed, perfectly functioning, with five capable and useful fingers, plus one thumb. Added to a tendency toward musical interest and ability, it would be a highly successful mutation; a six-fingered pianist or violinist would have real advantages.

The unfavorable mutations are important in only one way; they give us definite and unequivocal proof that mutation of man is proceeding—and at an astoundingly rapid pace. Statistics show that *thousands of these mutant humans are born every year.*

Mutation of man is *not* a rare, almost legendary thing—it's a common, but little discussed, thing. The lack of discussion devolves mainly from the fact that nearly all the direct evidence is on the black side. The tragedy is evident—and the only apparent evidence. The triumphs—are satisfied customers.

Unfavorable mutations are probably much more common than favorable ones. (There are more ways of not doing a thing than of doing it.) But the powerful offsetting factors at work are many and, as the history of two billion years of evolution shows, adequate. First, unfavorable mutants leading to nonviable types are never born—and that accounts for tens of thousands of mutants. Second, unfavorable mutations will, by the fact that they are unfavorable, reduce the chances of the mutant individual mating and reproducing the unfavorable property. Third, many unfavorable mutations

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lead directly or indirectly to physical inability to reproduce.

Against that set of factors, all tending to a short period of existence for the unfavorable mutant property, consider the status of the favorable mutation. Being advantageous, by definition it will make the possessor better able to secure a mate, and maintain children under favorable conditions. Sterility will be minimized. And all embryos possessing the characteristics will be viable forms, making better the chances for the new and improved type.

New unfavorable mutants will, in any given generation, exceed in number the newly occurring favorable mutations. But the favorable mutations, because their characteristics are self-maintaining, will continue to accumulate indefinitely, save as still further mutations in turn change them. Thus in a given generation, the total of new and previous favorable mutations will exceed the total of new and previous unfavorable mutants.

The process of accumulation of favorable traits must have been going on steadily since the beginnings of the race; in the brief period since the fall of the Roman Empire mutations numbering in the thousands must have occurred; mutant humans carrying those newly "invented" characteristics numbering in tens of millions have appeared. The favorable, and hence persisting characteristics, spreading through the race, make it highly *improbable that any man of today is a true racial descendant of the people of Roman times.* The accumulation of minor mutations in that length of time and number of generations would probably mean at least some degree of change in most of the population.

THERE IS, of course, another type of accumulation of mutant strains—individual accumulation. Since there must be several hundred minor

but useful, favorable mutation strains floating about in the race, what effect would be produced by the accidental but inevitable confluence of all, or nearly all of them? Since some two billion human beings are born each generation, the statistical probability that an occasional individual will appear with nearly all the favorable mutations compounded is reasonably good.

He would, in a very genuine sense, be a superman. In many ways he would approximate A. E. van Vogt's "tendriless Slan"—a man of human appearance, and fundamentally human in most ways. But his brain would work perhaps two or three times as swiftly and accurately as a normal or true human's. He would probably have extremely high immunity to most diseases, complete freedom from cancer, a slightly altered metabolism that prevented hardening of the arteries.

But he would not realize that he was—not human. Brought up by and among human beings, with the complete conviction that he was also an ordinary human being, there would be no reason for him to doubt a self-evident fact. That he was somewhat brighter than his friends and associates would be evident, but then, there is variation between men, of course. Such a man would naturally gravitate to a quick-thinking, clear-headed group of friends, men he found interesting. That those not-quite-so-brilliant friends represented, in fact, lesser accumulations of favorable mutations, that they in turn were not entirely human, would not obtrude itself, probably would not be recognized.

The mutant-accumulation-man would, in all probability, fit himself

smoothly—he's enormously adaptable, of course; adaptability is one of the favorable characteristics man needs—into business as a top-rank executive. His outstanding value—his most useful mutant quality—is the ability to make quick, accurate decisions. That same quality, incidentally, protects him against nervous breakdown; most insanity devolves fundamentally from inability to make a final decision, and, abiding by that decision, cease worry.

But modern business and industry pay—for value received—extremely high wages for people who make accurate, rapid decisions. Judgment—and the decisions which are its product—is the most valuable commodity in the world. Our superman, having the advantages inherent in his slightly inhuman inheritance, will find his business work easy, enjoyable, and profitable. In winning a mate, his adaptability and brilliance will make it possible for him to select at his choice; his inheritance will make that choice worthy.

The chances are that no perfect synthesis of all the favorable mutations of mankind has taken place—but it is as certain as the laws of probability that many accumulations approaching the maximum have appeared. All men may be born with equal opportunities—in America, at least—but they definitely aren't all born equal. They aren't even all born true human beings.

There's a lot of inevitable logic in the set-up Van Vogt proposed in "Slan." The supermen were the most intelligent beings on Earth. Where would you expect to find them if not running things on the planet?

And that's sound logic, whether you call them Slan or something else.



BRASS TACKS

I wonder if Dr. Rhine has studied extra-sensory perception between people who thought in different languages?

Dear Mr. Campbell:

A month ago I firmly resolved not to spend my time writing long letters to the editor around the third Friday in every month; but here I go again. This time I want to take exception to your little editorial.

Well—you undoubtedly know more about the subject than I do, and nobody knows very much that applies to telepathy, but—explain yourself a bit more fully, please. When anyone concentrates on a definite thought, he concentrates on the definite *words* of the thought, not on any pictures. He may think of the sound of the words, which he has heard, the motions necessary to say the words, which he has made, the sight of them, or any phase of those particular words which he has experienced. He thinks of some impression that word has made on his nerves, either sensory or motor; he definitely does not think of the meaning of that word. The meaning is, to him, implied by these impressions.

My point is that probably an interpreter would be necessary even between he who says "ein hund" and he who says "a dog." It seems likely that, even if telepathy were workable, a German concentrating hard on definite thoughts would only transmit to me the same meaningless expressions as would his speech or his writing—except that I

would get both the sound and the spelling, maybe.

Oh, sure, if he concentrates on a pooch it's O. K., because a mental picture could easily be substituted for the word in that case; but verbs are going to be difficult and abstract nouns a lot harder. In short, I agree with your conclusion, but think interpreters will still be necessary even between people speaking two different Earth languages.

Enough. Ratings:

1. "Time Wants a Skeleton"—A+
2. "A Matter of Speed"—A-
3. "Old Fireball"—B
4. "To Fight Another Day"—B
5. "Devil's Powder"—B
6. "The Purple Light"—B
7. "Artnan Process"—C

Rocklynne's story was perfectly fair to the reader. I don't say that because I solved the problem—oh, no.

"A Matter of Speed." The most unlikely story yet. I hate to have to admit it was good.

No article. Now, now, certainly you can give us at least two articles every issue—including the editorial.

I await "Methuselah's Children" with ye proverbial bated breath.

One more thing: Rogers can't keep it up. It doesn't seem possible to turn out a superb painting *every* month. How about spelling him off with Finlay?—Chandler Davis, 309 Lake Avenue, Newton Highlands, Massachusetts.

Two-hundred-incher still has months of grinding to go.

Dear Mr. Editor:

A flash from a far-off nebula! (Or not so far.) I, like many others, must admit that I have never before written to any magazine, which goes to show how much Astounding is appreciated even in this small corner of our planet. Yes, Astounding is not a stranger at all at our newsstands!

I have only been reading your magazine regularly for about a year now, except for an odd number or two previously, and realize that I have missed the best in science-fiction—and facts—for years. I like Astounding because, in the first place, it is *clean*, and I mean just that. And secondly, well, to cut a long story short, it stands alone in its class. It's the tops, as you Americans would put it.

Nothing would give me more pleasure than to discuss each and every story I have read so far, but that, for obvious reasons, cannot be done. It would also remind one of, say, a "shoe-shine boy" discussing and, of course, criticizing, the Statue of Liberty. What is there, in, on or above the Earth, which *Homo sapiens* (?) would not find fault with?

Now for the main points in my analysis: Best serial undoubtedly "Slan." In astronomical parlance, truly a Nova! Of the shorts, I liked "Farewell to the Master" the best. A beautiful story well told. More of its kind please, Mr. Editor. Or maybe there is a sequel already by now. Bond's "Legacy" was a real tonic. The laughter came right from the stomach.

One foolish question: Is the new two-hundred-inch telescope in use yet, and if so, was it worth it? Scientific news is very scarce these days.

Your ace artist is Rogers. Sack everybody but him. But for covers I prefer "space-eye" views to vague machinery and gadgets.

Well, I wish you and your splendid magazine every success, and if space travel becomes a reality one day, let us hope there will still be an Astounding to light the way ahead, or shout, "I told you so."—John B. La'buschaque, 21 Middlesex Street, Springs, Transvaal, South Africa.

Artists please note.

Dear Mr. Campbell:

Reader after reader has written you, declaring: "The art work in Astounding represents the magazine's weakest point." Al-

though I reservedly agreed, I did not, until this letter, add my voice to the chorus of art BRASS at TACKers. But the art work in the July issue struck me down! Kramer illustrating *three* stories—O Jordan!

As usual, Kramer blotted up a few pages, designated the results as "illustrations," and you—or your art editor—innocently accepted them. These so-called illustrations are undoubtedly the rottenest examples of art work that have appeared in any science-fiction magazine since I have been reading them. Not only does one have to read the story to understand the confused action portrayed in the picture, but he has to guess whether the weird, contorted characters pictured are deformed Terrestrials or Bug Men from Arcturus, a race that didn't follow de Camp's outline for extraterrestrial evolution.

Kramer's drawing for "Brown" was his best. Even there, although the people are astoundingly well-drawn—for him—the unsteady lines behind them, supposedly representing the steel beams, and the indistinct blot, which is perhaps the spider, are cruel to a weak stomach. The "Probable Man" frontispiece is worse; the headlight on the unbelievable tractor is out of line, and I still can't figure out what or who those figures are around the edges of the picture. But Mr. Kramer hits a putrid low in the "Spaceship in a Flask" drawing. Do robots *have* to look like that? And, though the story says, "One blow *dented* in the heavy metal," Kramer shows the "heavy metal" collapsed, shattered like rust-rotted tin. The poor robot's eyes still gleam—as robots' eyes seem to do—even after "death." There are other conspicuous faults with the drawing, but I won't go into that.

As for the other illustrators: Schneeman deserves a bunch of double petunias for the drawing on Page 68—a honey; he is usually successful. Kolliker surprises with a lucid drawing for "We Also Walk Dogs." If he keeps this up, give him more work to do. Rogers is O. K. on "Methuselah's Children," but he didn't half equal his excellent work for "Universe."

So—let's have more of Schneeman, Rogers, Kolliker—at times—and Cartier, with a beautiful job like his "Vault of the Beast" set; Wesso, yes-o-yes-o; dependable Dold, and even Orban, M. Isip, and—Gilmore. Don't give us any more illustrations by R. Isip, Jack Binder, Eron, or Kramer.

Finally, about covers: Rogers is getting stale; he is in a terrific slump. He has done two unworthy covers in a row, and has not

Painted an outstanding one since "Logic of Empire" in March. Rogers is good, but why not give some other artist a chance—Wesso, Schneeman, or Paul, perhaps? Incidentally, when can we expect another astronomical cover?

Analytical Laboratory—July, 1941

1. Methuselah's Children (Part I)
2. The Seesaw
3. We Also Walk Dogs
4. The Geometrics of Johnny Day
5. Spaceship in a Flask
6. The Probable Man

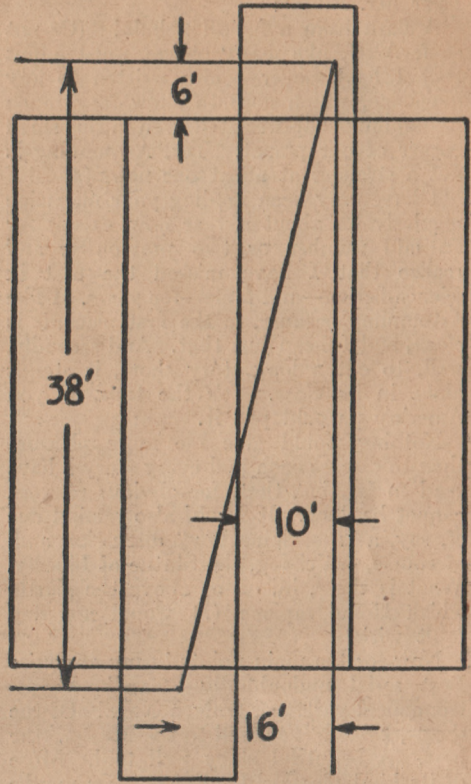
7. Brown—D. W. Boggs, 2215 Benjamin Street, N. E., Minneapolis, Minnesota.

"Engineers" still goes—there are more kinds than aeronautical engineers.

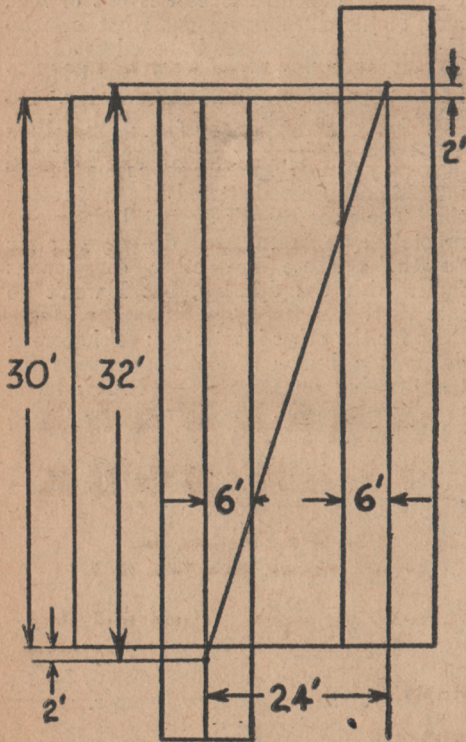
Dear Mr. Campbell:

Mr. Bond's Johnny Day slipped just a trifle in his geometrics. His routing of the lamp cord was not the shortest by nearly six inches. As shown in the accompanying diagrams the length by Johnny's method is $\sqrt{24^2+34^2}$ or 41.6 feet, while by my

method the length is $\sqrt{16^2+38^2}$ or only 41.2 feet.



KAHN



DAY

No doubt I'm going to be severely tramped upon by thus sticking out my neck, but it should at least cause Mr. Bond to attend more strictly to his math when writing something like that. Or maybe Johnny Day was a little rushed and slipped up. The "Möbius strip" was a very near rabbit to pull out of the hat.

I was much disappointed when you first became editor of Astounding, because I knew you'd not be able to write another "Mightiest Machine," but I've been consoled by such stories as "Slan," the Don Stuart works, and Heinlein.

I think you were a little hard on us engineers in your editorial on exhaust-jet propulsion. The aeronautical engineers together with the NACA worked out and developed the methods of ducting exhaust gas and cooling air which you described and are making use of this work in the high-speed fighters. North American, for instance, is using this principle in their new

pursuit, and while I don't know for sure, I imagine other companies are doing likewise. So not as many engineers as you imply will willingly jump in with both feet and yell, "Impossible!"—Robert F. Kahn, 725 Orange Street, Redlands, California.

R. Heinlein, producer.

Dear Mr. Campbell:

To the many names—mostly favorable—that Heinlein has been called, I'd like to add the term "producer." For isn't the correct definition of a producer—check me on this, de Camp—one who creates goods or renders services that satisfy human wants? And if Heinlein—and most of Campbell's clan of writers—doesn't satisfy a desire for good s-f literature, I'd like to know who does. Here's my point: I propose that the best writers be given the title "producer" as a term of merit. So that when the debonair de Camp or Heinlein—"heinous" might have sounded better, but would not have been exactly applicable—strolls down the street, people can exclaim with awe: "Gawrsh, *he's* a producer!"—and not mean a Hollywood magnate.

This outburst or chain of whacky thoughts was begun by the reading of Part I of another splendid Heinlein story, "Methuselah's Children." If the next two parts are as good as the first, it isn't unlikely that this serial might even surpass "If This Goes On," "Coventry" and "Universe." And to think that his first story appeared only two years ago!

In second place—the installment ranking first—comes "The Probable Man" with "We Also Walk Dogs" following closely in third. Though the former dealt with the slightly worn plot of time travel and the alternate-futures idea, the deft handling by Bester accounts for its position. The latter presents an extremely interesting and logical picture of the service companies of the future—somewhat different from those today!

In fourth place—though in reality second, third and fourth places could almost be lumped together as one—is "The Geometries of Johnny Day." This little tale bears a remarkable resemblance to the Space Lawyer series—the main difference being that the hero uses geometry instead of law.

You know what I think of Rogers' exquisite covers, so there's no use repeating that. However, the interior could be improved above its present mediocrity by the more frequent use of Rogers and Schneeman with perhaps Finlay.

Till the next issue.—Bill Stoy, 140-92 Burden Crescent, Jamaica, New York.

AST—9k

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IN TIMES TO COME



THE cover yarn next month will be "By His Bootstraps," a neat bit of utter confusion by Anson MacDonald. It takes the neat clarity of thought and expression of a writer like MacDonald to evolve so efficiently complete a befuddlement as this one. It involves a man who met himself—very definitely met himself, in a highly redundant sort of way, in fact. He came back to warn himself not to go, then came back to warn both hisselfes that he should, by all means—

Matter of fact, it's a case of the puppets being moved, the strings being plainly visible, the puppet-master being known—but no visible reason for the commotion. It looks as though Dictor, the puppet-master, has no reason, sane or insane, for causing the commotion. He has though—plenty of reason. Naturally, in such a yarn, the reason is redundant, too.

Treading hard on the heels of that long novelette, is another long one that could be a lot longer, save that there's a limit to the available space in the magazine. Bob Heinlein's done his sequel to "Universe." This one is called "Commonsense," and completes one cycle of the strange civilization among the unknown voyagers of the starship *Vanguard*. Hugh Hoyland, Joe-Jim, Bobo and company are back, with some more of Heinlein's peculiarly unattractive "Muties." Among minor characters, the "Mother of Knives" is recommended as worthy of attraction. Armorer and knife-maker for the Muties, this mutie hag is competent both in the making and using of knives—specially adapted to knife-fighting, in fact. She has a disposition thoroughly vicious enough, and natural equipment adequate to machine-gun knife-throwing technique. She's ambidextrous with *four* arms.

Then de Camp's article on the Age of Science that didn't quite make the grade, the Hellenistic Era, concludes with a highly interesting speculation as to what history might have been if it had *not* failed. Suppose that, two thousand years ago, modern science had gotten the start it actually did get about 1600 A. D. That it did not was pure accident. Allowing a similar rate of growth of technical advances—the fact that it did not has robbed us, who were born in the Twentieth Century, of our proper heritage of interplanetary, quite probably interstellar travel. We will live under conditions that should have vanished a millennium ago, die of causes that should have been conquered more than twenty lifetimes ago. We of 1941 should, in fact, be doing things that were a thousand years in the future of the people of Heinlein's "Methuselah's Children."

Next month's "In Times to Come" will give a bit more information about that long-awaited Dr. E. E. Smith sequel to "Gray Lensman." Hubert Rogers is working up the cover and illustrations on it right now. They look, in preliminary sketches, as though we'd have an exceptionally good cover.

THE EDITOR.



Methuselah's Children

By Robert Heinlein

Concluding a novel of long-lived men driven to a terrible hegira by the jealousy of the short-lived—and the pressure of utterly alien psychologies and philosophies!

Illustrated by Rogers

In the early Twenty-second Century the serene civilized culture which followed the overthrow of the Prophet was thrown into mob hysteria by the revelation that the HOWARD FAMILIES, an artificially se-

lected genetic group, have the gift of incredibly long life, two or three times normal.

LAZARUS LONG, born in 1912 and separated from the Families for more than

a century, returns to Earth and to his kinfolk in time to assume leadership when the Families are threatened. He persuades ZACCUR BARSTOW, Chairman of the Families, to surrender the secret roster of the Families to SLAYTON FORD, Administrator of the Western Federation, so that Ford may have the Members arrested—only thus is it possible to save the Members from mob violence, since the normal short-lived majority are convinced that the Families have maliciously kept the "secret" of longevity to themselves.

Lazarus, Zaccur and Administrator Ford conspire to have the Families escape to another star by means of the New Frontiers, a giant interstellar ship then being readied for exploration in an orbit between Earth and the Moon. In the confusion of the mass arrest of the Families, Lazarus escapes alone. Being a hard-boiled pragmatist, he at first plans to assume another identity and disappear. But he reconsiders—the prospect of being the only Methuselah in a race of ephemerals is too depressing. Besides, his friend MARY RISLING, a young woman aged one hundred eighty years, observed his escape; he does not relish appearing traitorous in her eyes.

He contacts Ford, arranges to assist the conspiracy under cover. He goes to Luna City where he buys an old space freighter, trading in his yacht on the deal. Lazarus reconnoiters the New Frontiers at the same time. Returning to Earth, he is informed by Ford that the mass escape must take place at once, as the political situation is getting out of hand—Ford's opposition in Council are demanding that Ford use the scientific tortures developed under the Prophets to force the nonexistent "secret" from the Families.

The Families are concentrated in a "Little Coventry" in Oklahoma. Under cover of a violent storm, ordered by Ford from the Weather Control Bureau, Lazarus evacuates his kin in the freighter and ferries them to the New Frontiers. As they are getting under way, Ford arrives and asks to join them—his part in the conspiracy has been discovered; he is out of office, and is fleeing for his life.

The Federation's naval vessels pursue them toward the Sun. Ships from Venus force them off course and dangerously close to the Sun. ANDREW JACKSON LIBBEY, intuitive mathematical genius, has invented a space drive which uses light pressure under condition of no inertia. It is hooked up and the New Frontiers scoots

out of the Solar System at a speed just under that of light.

It takes ten long years to reach the nearest available sun-type star, during which time the travelers take turns in frozen sleep. At last, such a star is reached; it has an Earth-type planet; CAPTAIN KING prepares to send Lazarus down with a scouting party.

He is interrupted by the nurse in charge of the Families' numerous mental defectives, many of whom are sensitive to telepathy. One such, a semi-moron, has demanded of her that she arrange for him to go with the scouting party—his "Friends" expect him!

They do indeed. The planet's inhabitants, an intelligent nonhuman android people, greet him royally and inform Lazarus, through him, telepathically, that his companions are welcome to settle on the planet.

The JOCKAIRA assist the terrestrials in every way to found a permanent colony, even turning over an entire city for their use. But notwithstanding their ubiquitous friendliness and helpfulness it is very difficult for the humans to understand the natives—the cultures are widely different, the languages are structurally different, the customs, evaluations, et cetera, are not equivalent. Such matters produce minor frictions which are usually ironed out until

KREEL SARLOO, Jockaira tribal chief, calls on Zaccur Barstow and informs him that the time has come for the terrestrials to "choose their names," i.e., pick a local tribe and temple.

At a conference of Family leaders it is decided that conforming superficially to the local religion is sound policy if it will please their hosts. Ford volunteers to take the plunge first.

Lazarus accompanied Ford to the temple where Ford was to be adopted into the local religion. He waited uneasily outside. At last he saw Ford run headlong from the temple and fall to the ground. He ran to his side and was horrified to discover that Ford had suffered a violent mental breakdown. A shadow fell across them—Kreel Sarloo. "What happened?" Lazarus demanded.

Sarloo's manner was no longer friendly. "This is a bad thing."

"You're telling me!" Lazarus retorted.

THE same conference as before, but minus its chairman, met again as quickly as could be managed.

Lazarus told his tale; Schultz reported on Ford's condition. "All I can tell you," said Schultz, "is that the Administrator is suffering from an undiagnosed extreme neurosis. I can't get into communication with him—"

"Won't he talk at all?" asked Barstow.

"A word or two, on subjects as simple as food or water. Any attempt to get at the cause of his trouble drives him into incoherent hysteria."

"No diagnosis?"

"Well, if you want an unprofessional guess in loose language, I'd say he was scared out of his wits! But," he added, "I've seen fear hysterics before. This one is not like any I've ever seen."

"I have," Lazarus said suddenly.

"You have? Where? What were the circumstances?"

"Once," said Lazarus, "when I was a kid, a couple of hundred years back, I caught a grown coyote and penned him up. I had a notion I could train him to be a hunting dog. It didn't work.

"Ford acts just like that coyote did."

An unpleasant silence followed the guarded sinister anecdote. Schultz broke it with, "I don't know quite what you are getting at. What is the parallel?"

"Well," said Lazarus slowly, "this is just my guess. Ford is the only one of us that knows the true answer, and he can't talk. But here is my opinion: We've had these Jockaira doped out all wrong from scratch. We made the mistake of thinking that because they looked like us, in a way, and were about as civilized as we are, that they were people. They aren't people at all—"

"They are *domestic animals*."

"Wait a minute, now," he added,

"don't get in a hurry. There are people on this planet, right enough. Real people. They live in the temples and the Jockaira call them gods! They *are* gods!"

Lazarus pushed ahead with his argument before anyone could interrupt. "I know what you're thinking. Forget it. I'm not going metaphysical on you. I mean that there is something living in those temples, and whatever it is, it's such heap big medicine that it can pinch-hit for gods, and you might as well call 'em that. Whatever they are, they are the real dominant race on this planet—the *people!* The rest of us are just animals, wild or tame. We made the mistake of assuming that a local religion was just superstition. It ain't."

"And you think that was what happened to Ford?"

"I do. He met one, the one called Kreel, and it drove him crazy."

"I take it," said Schultz, "that it is your theory that any man exposed to this . . . this *presence* . . . would go insane?"

"Not exactly," answered Lazarus. "What scares me a damn sight more is the fear that I might *not* go crazy!"

THE Jockaira, that day, withdrew completely from contact with the Earthmen. It was well that they did so; once the news raced through the settlement a Jockaira would undoubtedly have caused a murderous riot by his mere presence. Fear hung over the city, fear of a horror much worse than death, fear of some terrible nameless *thing*, the mere knowledge of which could turn a man to a broken, mindless animal. The Jockaira seemed no longer harmless friends, rather ludicrous despite their scientific attainments, but puppets, decoys, *bait* for the unseen

potent beings that lurked in the "temples."

There was no need to put the matter to a vote; with the simple unanimity of a crowd rushing from a burning building, the Earthmen sought to leave this terrible place.

Zaccur gave the orders. "Get King on the screen. Tell him to send down every boat at once. We'll get out of here as fast as we can." He ran his hands distractedly through his hair. "It will take at least a dozen trips to evacuate them all. How long will that take?"

Lazarus muttered something.

"What did you say?"

"It ain't a case of how long; it's a case of will we be let. The things in the temples may want more domestic animals—us!"

Lazarus was needed as a pilot, but he was needed more urgently for his ability to manage a crowd. Zaccur was authorizing him to drum up an emergency corps of military police to maintain order in the loading, when Lazarus, looking past Zaccur's shoulder, exclaimed, "Oh, oh! School's out."

Zaccur turned his head quickly and saw, approaching with stately dignity across the subterranean hall, Kreel Sarloo. None impeded his progress.

They soon found out why. Zaccur moved forward to greet him, found himself stopped ten feet from the Jockaira. No details, no clue to the cause; just that—stopped!

"I greet you, unhappy brother," Sarloo began.

"I greet you, Kreel Sarloo."

"The gods have spoken. Your race can never be civilized (?). You and your brothers are to leave this world."

"We are leaving, Kreel Sarloo."

Lazarus sighed with relief. The gnawing doubt in his mind had been

whether or not they would be permitted to leave.

"The gods require that you leave. Send your brother Libbey to me."

Zaccur saw to it that the message was sent, then turned back to Sarloo. But the Jockaira had nothing more to say to them. He seemed indifferent to their presence. They waited.

Libbey arrived. Sarloo engaged him at once in a long conversation. Barstow and Lazarus stood within earshot, could see their lips move, but heard nothing. Lazarus found the circumstance considerably more than disquieting. "Damn my eyes," he thought, "I could figure out several ways of pulling that trick with proper equipment, but I'll bet that none of them is the right answer."

The silent discussion concluded, Sarloo stalked off without speaking. Libbey turned to the other two and spoke. This time his voice could be heard. "Sarloo tells me," he began, brow wrinkled in puzzlement, "that we are to go to a planet over—uh—thirty-two light years from here. The gods have decided it." He stopped and bit his lip.

"Don't worry about it," advised Lazarus. "Be glad they want us to leave. My guess is they could have squashed us flat just as easily. Once we are out in space we can pick our own destination."

"I suppose so. But the thing that troubles me is that he mentioned a time about three hours away for our departure from this system."

"Why, that is impossible," protested Zaccur. "We haven't the boats to do it." Lazarus said nothing. He was ceasing to have opinions.

Zaccur changed his opinion quickly. Lazarus acquired one, born of experience. While hurrying to

the field where embarkation was to take place, he found himself lifted up, free of the ground. He struggled, his limbs encountered no resistance, but the ground dropped away rapidly. He closed his eyes, counted to ten, and opened them again. He was at least two miles in the air.

Below him, shooting up out of the city like bats from a cave, were uncountable numbers of dots and shapes, dark against the sunlit ground. Some of them were close enough to him for him to see that they were men, Earthmen—the Members.

The horizon dipped down; the planet became a sphere; the sky turned black. Yet his breathing seemed normal; his blood vessels did not burst.

They were sucked into clusters around the open ports of the *New Frontiers* like bees swarming around a queen. Once inside the ship, Lazarus gave himself over to a case of the shakes. *Whew*, he sighed to himself, watch that first step—it's a honey!

Libbey sought out Captain King as soon as he was inboard the ship and had recovered his morale. He delivered his message from Sarloo.

The captain seemed undecided. "I don't know," he said. "You know more about the natives than I do, seeing that I have hardly set foot on the ground. Between ourselves, mister, the way they sent my passengers back to me has me talking to myself. That is the most remarkable evolution I have ever seen performed."

"I might add that it was remarkable to experience," Libbey added unhumorously. "Personally, I would prefer to take up ski jumping. I'm glad you had the ship's access ports open."

"I didn't," King said tersely. "They were opened for me."

They repaired to the control room with the intention of getting the ship under way and placing a long distance between it and the planet from which they had been evicted. Thereafter they would consider courses and destination. "This planet Sarloo described to you," said King, "does it belong to a G-type star?"

"Yes," Libbey confirmed, "an Earth-type planet accompanying a type-G star. I have its space-time co-ordinates and will be able to identify it from the catalogues. But we can forget it; it is too far away."

"So—" King threw in the circuit which activated the vision system for the stellarium. Neither of them had anything to say for several long moments. The images of the heavenly bodies told their own story.

With no orders from King, with no hands at the controls, with no feeling of acceleration, the *New Frontiers* was under way, headed out again, as if she had a mind of her own.

"I CAN'T TELL YOU MUCH," admitted Libbey some hours later to a group consisting of King, Zaccur Barstow, and Lazarus. "I was able to determine, before we passed the speed of light—or appeared to—that our course was compatible with the idea that we have been headed toward the star mentioned by Krel Sarloo as the destination selected by his gods. We continued to accelerate and the stars faded out. I no longer have any astrogational reference points and am unable to say where we are or where we are going."

"Loosen up, Andy," suggested Lazarus, "make a guess."

"Well—if our world line is a symmetrical function—if it is—then we

will arrive in the neighborhood of Star PK3792, where Kreeel Sarloo said we were going."

"Hm-m-m." Lazarus turned to King. "Have you tried slowing down?"

"Yes," said King shortly, "the controls are dead."

"Hm-m-m—Andy, when do we get there?"

Libbey shrugged helplessly. "I have no frame of reference. What is time without space reference?"

Time and space, inseparable and one. To be sure, Libbey had the space framework of the ship itself, and therefore necessarily, ship's time. The ship's clocks ticked, or hummed, or simply marched. Men became hungry, fed themselves, became tired, rested. Radioactives deteriorated, physiochemical processes moved toward greater entropy, consciousness perceived duration.

But the background of the stars, against which every timed function in the history of man has been measured—directly or indirectly—was gone. So far as any instrument within the ship could tell them, they had become *not relevant* to the rest of the universe.

What universe?

It was gone.

Did they move? Is there motion when there is nothing to move *past*?

Yet the pseudogravitation, the false weight, achieved by the spin of the ship, persisted. "Spin with reference to what?" thought Libbey. Could it be that space held a true, absolute, nonrelational texture of its own, like the hypothetical and long-discarded ether, even though the classic Michelson-Morley experiments had failed to detect it? No, more than that—had denied the possibility of its existence.

Had for that matter denied the possibility of a speed in excess of

light. Had the ship passed the speed of light? Was it not more likely that this was a coffin, with ghosts as passengers, going nowhere at no time?

But he itched between his shoulder blades and was forced to scratch; his left leg had gone to sleep; his stomach spoke insistently of food—if this constituted being a ghost, he found no perceptible change in it from living.

With renewed tranquillity, he moved toward his favorite refectory, and grappled with the problem of inventing a mathematics which would include all the new phenomena he had experienced. The mystery of how the hypothetical Jockaira gods had teleported the Families from the planet to the ship he discarded. There had been no opportunity to obtain data, *measured* data; the best that any honest scientist could do, with epistemological rigor, would be to include a footnote which admitted the fact and noted that it was unexplained. It *was* a fact; here he stood who had been shortly before on the planet; Schultz's assistants even now were overtaxed to administer depressant drugs to the many thousands who had gone to pieces emotionally under the experience.

He felt no more need nor ability to explain the matter than a squirrel to explain a stereocaster. What he did wish to do was to deal with world lines in a plenum, the basic problem of field physics.

Libbey, aside from his penchant for mathematics, was a simple person. He preferred the noisy atmosphere of the Club, refectory 9-D, for somewhat different reasons from those of Lazarus. The presence of persons younger than himself placed less strain on his self-confidence.

Food, he found, was not immedi-

ately available at the Club; the commissary was still adjusting to the sudden change, but Lazarus was there, and others whom he knew. Nancy Weatheral made room for him. "You're just the man I want to see," she said. "Where are we going this time, and when do we get there?"

He explained the dilemma as well as he could. Nancy wrinkled her nose. "That's a cheerful prospect, I must say! Well, I suppose that means back to the grind for little Nancy."

"What do you mean?"

"Have you ever taken care of a somnolent? No, of course you haven't. It gets tiresome. Turn them over, bend their arms, bend their legs, work their fingers, twiddle their tootsies, move their heads, close the tank, and move on to the next one. I get so sick of human bodies I'm tempted to take a vow of chastity."

Eleanor Johnson spoke up. "I'm glad to be in the ship again. Those slimy Jockaira—ugh!"

"You're prejudiced. The Jocks were O. K. Sure, they weren't people like us, but neither are dogs. You don't dislike dogs, do you?"

"That's what they were," said Lazarus soberly, "dogs."

"Huh?"

"I don't mean that they weren't anything like dogs in most ways—they weren't even vaguely canine, and they certainly are the equals and probably the superiors of the human race in intelligence and sensitivity—but they were dogs just the same. Those things we called their gods were simply their masters, their owners. We couldn't be domesticated, so they chucked us out."

Libbey was thinking of the inexplicable telekinetics the Jockaira—or their masters—had used. "I wonder

what it would have been like," he said thoughtfully, "if they had domesticated us. They could have taught us a lot of wonderful things."

"Forget it," Lazarus said shortly. "It's not a man's place to be property."

"What is a man's place?"

"It's man's business to be what he is—and be it in style!" Lazarus got up. "Got to go."

LIBBEY STARTED to leave, also, but Nancy stopped him. "Don't go. I want to ask you some questions. What year is it back on Earth?"

Libbey started to answer, closed his mouth. He started to answer a second time, finally said, "I don't know quite how to answer that question. It's like asking, 'How high is up?'"

"I know I phrased it wrong," admitted Nancy. "I didn't do very well in basic physics, but I did gather the idea that time is relative and simultaneity is an idea which applies only to two points close together in the same framework. But just the same, I want to know something. We've traveled a lot faster and farther than anyone ever did before, haven't we? Don't our clocks slow down, or something?"

Libbey got the completely baffled look which mathematical physicists are prone to get when a layman attempts to talk about physics to them in nonmathematical language. "You are talking about the Lorentz-Fitz-Gerald contraction. But, if you will pardon me, anything you say about it in words is necessarily non-sense."

"Why?" Her manner was insistent.

"Because—well, because the language is inappropriate. The mathematical formula used to describe the effect loosely called a contraction presupposes that the observer is a



part of the phenomenon. Verbal language contains the implicit assumption that we can stand outside the whole business and watch what goes on. The mathematical language denies the possibility of any such outside viewpoint. Every observer has his own world line; he can't get outside it to see what happens."

"But suppose he did? Suppose we could see the Earth right now?"

"There I go again," said Libbey miserably. "I tried to talk about it in words, and all I did was add to the confusion. There is no way to measure time in any absolute sense when two events are separated in a continuum. All you can measure is interval."

"Well, what is interval? So much space and so much time."

"No, no, no! It isn't that at all. Interval is—well, it's interval. I can write down the formula for it and show you how we use it, but it can't be defined in words. Look, can you write down the score of a full orchestration of a symphony in words?"

"No. Well, maybe you could, but it would take thousands of times as long."

"And it still wouldn't mean anything until it was translated back into notes and so forth that musicians can follow. That's what I meant," Libbey went on, "when I said that the language was inappropriate. I got into a difficulty like this once before in trying to describe the light pressure space drive. I was asked why, since the drive depended on loss of inertia, the persons inside the ship had felt no loss of inertia. There was no answer—in words. Inertia isn't a word, it's a mathematical concept used in describing *mathematically* certain aspects of a plenum. I was stuck."

Nancy looked baffled, but was

doggedly persistent. "My question still means something, even if I didn't phrase it right. You can't just tell me to run along and play. Suppose we turned around and went back the way we came, all the way to Earth, and the trip took—oh, call it ten years, ship's time. What year would it be on Earth?"

"It would be— Let me see, now —" The almost automatic processes of his brain commenced running off the incomprehensibly huge and involved problem in accelerations, intervals, difform motion. He was approaching the answer with a warm glow of mathematical reverie when the problem suddenly fell to pieces on him, became indeterminate. He abruptly realized that the problem was double-ended, and that the formulas were reciprocal. It made all the difference in the world whether he figured it from the reference frame of the ship or the reference frame of the Earth. But that was impossible; in physical terms, two simultaneous answers equaled one absurdity.

When two world lines *re*-intersect, what time is it?

Could the whole beautiful structure of relativity be an absurdity? Or did it mean that it was impossible ever to back-track an interstellar distance?

"I'll have to give some thought to that one," he said hastily, and left before she could object.

But solitude and contemplation gave him no clue to the problem. It was not a failure of his mathematical ability; he was capable, he knew, of describing mathematically the facts, whatever they might be. The difficulty lay in the paucity of facts. Until some observer traversed interstellar distances at speeds approximating the speed of light and *returned to the planet from which he*

had started, there could be no answer. Mathematics alone has no content, gives no answers.

He found himself wondering if the hills of his native Ozarks were still green, if the smell of wood smoke still clung to the trees in the autumn, then recalled that the question lacked meaning by any rules he knew of. He surrendered to an attack of homesickness such as he had not experienced since he was a youth in the Cosmic Construction Corps, making his first deep-space jump.

THE SENSE of doubt and uncertainty, the feeling of lostness and nostalgia, spread throughout the ship. On the first leg of their journey the Families had had the kind of incentive that kept the covered wagons moving painfully over the plains. Now they were going nowhere; one day led only to the next. Their long lives were a meaningless burden.

Ira Howard, whose fortune established the Howard Foundation, was born in 1825 and died in 1873—of old age. He sold groceries to the Forty-niners in San Francisco, became a sutler on a major scale in the war between the States, multiplied his fortune during the tragic reconstruction.

He was deathly afraid of dying. He hired the best doctors of his time to prolong his life. They could not manage it—but his will (he died a bachelor) commanded that his money be used to "lengthen human life." The practical scientists who administered the trust saw no way to accomplish this purpose other than by seeking persons whose family trees showed a congenital predisposition to long life, and then persuading them to marry and reproduce in kind. They anticipated the method of Burbank, but may have

known of the illuminating work of the Monk Mendel.

The godchildren of Ira Howard's stubborn will achieved the long life denied him, achieved it to languish in the stupor of cold rest, or fret away their endless days in homesickness.

Mary Risling put down the book she had been reading when Lazarus entered her stateroom. He picked it up. "What are you reading, sis? 'Ecclesiastes.' Hm-m-m—I did not know you were religious." He read aloud:

"'Yea, though he live a thousand years twice told, yet hath he seen no good: do not all go to one place?'"

"Pretty grim stuff, Mary." His eyes skipped on down; he began again:

"'Remember now thy Creator in the days of thy youth, while the evil days come not, nor the years draw nigh when thou shalt say, I have no pleasure in them—' That's more like it. 'While the evil days come not—' Don't let 'em come!'"

She passed a hand wearily across her eyes. "Lazarus, I'm getting old."

"You? Why, you're as fresh as a daisy! I'm way older than you are."

She looked at him. She knew that he lied; her mirror showed her the graying hair, the relaxed skin; she felt it in her bones. Yet he *was* older than she; furthermore, she had learned enough of biology while she had been assisting in longevity research to know that he should *not* be as old as he was. When he was born, the Howard Foundation program had reached only to the third generation, too short a time to permit complete elimination of the less-durable strains—except, possibly, by some improbable mathematical chance. "Lazarus," she said, "how long do you expect to live?"

"Me? Now that's an odd ques-

tion. I remember a time when I asked a chap that very same question—how long would I live, I mean; not how long he would live. Ever hear of Dr. Hugo Pinero?"

"Pinero. Pinero—oh, yes, 'Pinero the Charlatan.'"

"Mary, he was no charlatan. He could *do* it, I tell you. He could tell accurately when a man would die."

"But— Go ahead. What did he tell you?"

"Just a minute. I want you to realize he was no fake. Too many of his predictions checked out while he was still alive—chaps hit by taxicabs, or trolley cars, or killed in plane crashes. Anyhow, he took my reading and it seemed to confuse him. He took it again. Then he gave me my money back."

"What did he say?"

"I couldn't get a word out of him. He looked at me and he looked at his machine, but he wouldn't say anything. So I can't rightly answer your question."

"But what do you think about it? You surely don't expect to go on forever?"

"Mary," he said softly, "I'm not *planning* on dying. I'm not *planning* on it at all."

There was a silence. At last she said, "Lazarus, I don't *want* to die. I still don't want to. But what is the purpose of our long lives? We don't seem to grow much wiser as we grow older. Are we simply hanging on after our time has passed? Are we loitering in the primary class when we should be moving on? Those creatures the Jockaira worshiped—it does not seem possible that any amount of living could raise us up to that level. Must we die and be born again?"

"I don't know," said Lazarus, "and I'm damned if I am going to worry about it. I propose to hang

on to this life as long as I can and learn as much as I can. Maybe wisdom and understanding are reserved for a later existence and maybe they aren't for us at all. Either way, I'm satisfied to be living and enjoying it."

THE FLIGHT to Star PK3722 took seventeen months and three days, ship's time.

The ship's officers had as little to say about the termination of it as they had had to say about the inception. A few hours before the terminus the stars flashed back into view on the stellarium screens, though they were not yet visible to the naked eye. The ship decelerated to interplanetary speed in a little time as she had accelerated, although no feeling of sudden stoppage could be felt in the ship. Whatever mysterious force controlled the ship acted on all masses within it alike.

The *New Frontiers* slipped into an orbit close about a live green planet some hundred million miles from its sun. Libbey reported to King that they had steadied down into a stable, nearly circular orbit. King tried the controls, dead since they left the planet of the Jockaira. The ship leaped ahead; he quickly applied an equal counteraction.

They were free. Their ghostly pilot had left them.

The simile was incorrect, as nearly as Libbey could figure it out. Their trip had been planned for them, undoubtedly, but it was not necessary to assume that anyone or anything had accompanied them. Libbey suspected that the "gods" of the dog-people saw the plenum as static; the deportation was an accomplished fact before it began. In another sense, the *New Frontiers* had been constrained to follow a cosmic "cam"; when it reached the end of the cam it returned again to normal operation.



the
fairy
changeling...

turned out to be a full-grown American in the diplomatic corps!

● It all happened when Scotch was substituted for milk in the fairy's bowl. The fairy drank the Scotch and—even as you and I—became a little confused. The result was the strangest prank ever perpetrated on Oberon and Titania. Shakespeare never dreamed of this possibility for "Midsummer's Night Dream"—but L. Sprague de Camp and Fletcher Pratt carry out the idea to its nonsensical, hilarious heights in

● LAND OF UNREASON, a full-length novel appearing in October UNKNOWN—an issue that will introduce this magazine in new dress—larger than ever. And henceforth to be known as

Unknown Worlds

ON SALE AT ALL NEWSSTANDS

Neither King nor Libbey had time to give the matter much thought. Lazarus' face appeared on the inter-station visiscreen. "Skipper," he said, "better come on back to Lock 7. We've got visitors!"

Lazarus had exaggerated the number; there was one visitor. King was reminded forcibly, as he looked on the visitor, of a child in fancy dress, pretending to be a rabbit. The creature was more android than the Jockaira, though possibly not mammalian. It was unclothed, but not naked, for its childlike figure was covered with short sleek golden fur. Its eyes were bright and seemed to be both merry and intelligent.

But King was too bemused to note much of physical detail. A voice, a thought, was ringing in his head. "—and you are the group leader," it said. "Welcome to our world—we have been expecting you—the told us of your coming—"

Controlled telepathy.

Controlled telepathy lodged in a race so gentle, so civilized, so free from enemies, from danger and strife, that they could afford to share their thoughts with others. So gentle and so generous that they were offering the humans a homestead on their planet—for such, it developed, was the messenger's purpose.

To King's mind this seemed remarkably like the prize package that had been offered them by the Jockaira; he wondered what the trap might be in this offer. The messenger seemed aware of his thought. "—look into our hearts—we hold no malice toward you—we share your love of life and love the life in you—"

The messenger departed. King turned suddenly to Lazarus. "Where did he go? I was just going to ask him— Never mind; where did he go?"

"I didn't see him go," admitted

Lazarus. "For that matter, I didn't see him arrive. I simply found him there by the lock."

"He must have gone out through it, but I didn't see it open. Do you suppose he can pass through—" King stopped, reluctant to express the thought.

"Maybe," said Lazarus. "I've got no more prejudices in the matter than the Red Queen. What happens to a phone image when you cut the circuit?" He walked off suddenly, whistling softly to himself. King could not place the tune. The words, which Lazarus did not sing, started with:

*"Last night I saw upon the stair,
A little man who wasn't there—"*

But there appeared to be no drawbacks to the offer. The people of the planet—they had no spoken name for themselves; the Earthmen simply called them the Little People—really did welcome them, and help them. There existed no difficulty of communication such as there had been with the Jockaira. The Little People could make their thoughts known to the Earthmen, and in turn could read the sense of any speech directed at them. They appeared not to be able to sense anything not intended as a message to them, nor did nonsensitive Earthmen acquire any gift of telepathy among themselves through this curious one-sided telepathism.

The planet of the Little People resembled Earth in many respects even more strikingly than did the planet of the Jockaira. It was a little larger than Earth, but the surface gravitation was slightly less, possibly due to a lower proportion of heavy metals. The Little People used less metal than any Earth culture, which may be indicative.

The planet rode upright in its or-

bit; it had not the rakish tilt of the Earth's axis. Furthermore its orbit was more nearly circular than that of the Earth; aphelion differed from perhelion by less than one percent. There were no seasons.

Nor was there a great heavy moon, such as the Earth has, to wrestle its oceans about and to disturb the isostatic balance of its crust. Its hills were low, its winds were gentle, its seas were placid. To Lazarus' disappointment, their new home had no lively weather; it hardly had weather at all; it had climate, and that of the sort that California patriots would have the rest of Earth believe exists in their part of the globe.

Except that on the planet of the Little People it really did exist.

The Little People indicated to the Earthmen where they were to land—on a wide, sandy stretch of beach running down to the sea. Back of the low break of the bank lay mile on mile of lush meadowland, broken by irregular clumps of bushes and trees. The landscape had a careless neatness, as if it were a planned park, though there was no evidence of cultivation.

It was here, a messenger told the first sortie of Earthmen, that they were welcome to live.

There seemed always to be one of the Little People present when his help might be useful—not with the jostling, inescapable overhelpfulness of the Jockaira, but with the unobtrusive, ready availability of a visiphone, or a pouch knife. The one who accompanied the first party of explorers confused both Lazarus and King slightly by assuming casually that he had met them before, that he was, in fact, the messenger who had visited them in the ship. Since his fur was a rich mahogany rather than golden, King attributed the error to difficulty of communication,

with a mental reservation that these people might possibly be capable of chameleonlike changes. Lazarus reserved his judgment.

KING ASKED their guide whether or not his people had any choice as to where and how the Earthmen were to place their buildings. The question had been bothering him because the preliminary survey in landing had shown no cities.

He spoke in words directed at the guide; experience had taught them already that the natives could sense their thoughts best when those thoughts were disciplined by spoken words.

In the thought which the little creature flashed back, King caught the emotion of surprise. “—must you sully the sweet countryside with interruptions?—to what purpose do you need to form buildings?—”

“We need buildings for many purposes,” King explained. “We need them as shelter, as a place to sleep. We need them to grow our food and prepare it for eating.” He considered the idea of trying to explain the processes of hydroponics, of food processing, and of cooking, then dropped it, trusting that the subtle sense of telepathy would enable his “listener” to understand. “We need buildings for many other purposes, for workshops and laboratories, to house the machines whereby we communicate, for almost every process of our everyday life.”

“—be patient with me—” the thought came, “—since I know little of your ways—but tell me—do you prefer to sleep in such as *that?*—” He gestured toward the line of ship's boats, where their bulges showed above the low bluff. The thought he used for the boats was too strongly emotional to be bound by a word; in Lazarus' mind came a

thought of a dead, constricted space, a jail that had once harbored him, a smelly public communication booth.

"It is our custom."

The creature leaned down and patted the turf. "—is this not a good place to sleep?—"

Lazarus admitted to himself that it was. The ground was covered with a soft, springy turf, grasslike, but finer than grass; softer, more even, silkier, and set more closely together. Lazarus took off his sandals and let his bare feet enjoy it, toes spread and working. It was, he decided, more like a heavy fur rug than a lawn.

"—as for food—" their guide went on, "—why struggle so for that which the good soil gives freely?—come with me—"

He took them across a reach of meadow to where low, bushy trees hung over a meandering brook. The "leaves" were growths the size of a man's hand, irregular in shape, and an inch or more in thickness. The little person broke one off and nibbled at it daintily.

Lazarus plucked one and examined it. It broke easily, like a well-baked cake. The inside was creamy yellow, spongy but crisp, and had a strong, pleasant odor, reminiscent of mangoes.

"Don't eat that!" said King. "It hasn't been analyzed."

"—it is harmonious with your body—"

Lazarus sniffed it again. "I'm willing to be a test case, skipper."

"Oh, well—" King shrugged. "Go ahead."

Lazarus did. The stuff was oddly pleasing, firm enough to suit the teeth, piquant though elusive in flavor. It settled down in his stomach and made itself at home.

King refused to permit anyone else to try the fruit until the effect on

Lazarus was established. Lazarus took advantage of his exposed and privileged position to make a full meal, the best, he thought, that he had enjoyed in years.

"—will you tell me what you are in the habit of eating?—" inquired their little friend. King started to reply; he was checked by the creature's thought. "—all of you—think about it—" No further image came from him for a moment or two, then he flashed, "—that is enough—my wives will take care of it—"

Lazarus was not sure that the thought image meant wives, but some similar close relationship was implied. It had not yet been established that the Little People were bisexual—or what.

Lazarus slept that night under the stars, and let their clean, impersonal light rinse from him the claustrophobia of the ship. The constellations here were distorted out of recognition, though he fancied that he could identify the cool blue of Vega and the orange glow of Antares. The one certainty was the Milky Way, its cloudy arch still spilling across the sky. The Sun, he knew, would not be visible even had he known where to look for it; its low magnitude could not reach the naked eye across sixteen light years. Have to get hold of Libbey, he thought sleepily, and pick it out with instruments. He fell asleep before it occurred to him to wonder why it mattered.

ALL but King slept outdoors the second night.

The fact that shelter at night was unnecessary enabled them to land all their personnel as fast as the ship's boats could make the round trip. The crowds were simply dumped on the friendly soil and allowed to rest, picnic fashion, while the colony was being reorganized.

At first they fed mainly from supplies brought down from the *New Frontiers*, but Lazarus' continued good health warranted King relaxing the injunction against natural native food; the colonists thereafter subsisted largely on the largess of the plants and used the transported food only to vary their diet.

Lazarus found himself accosted by one of the Little People while walking—exploring—some distance from the base camp. The native greeted him with the same assumption of previous acquaintance which all of the Little People seemed to show, and led him to a grove of trees which lay beyond, farther from the camp. He indicated to Lazarus that he was to eat therefrom.

Lazarus was not particularly hungry, but one felt compelled to be accommodating in dealing with such friendliness. He plucked and ate.

He almost choked in his astonishment. Mashed potatoes and brown gravy!

"—didn't I get it right?" came an anxious thought.

"Bub," said Lazarus aloud, "I don't know what you planned to do, but this is O. K."

A warm burst of pleasure invaded his mind. "—try the next tree—"

Lazarus did so, somewhat more cautiously—fresh brown bread and sweet butter seemed to be the combination, though a dash of ice cream appeared to have crept in from somewhere. He was hardly surprised when the third tree gave strong evidence of having both mushrooms and steak in its ancestry. "—we used your thought images almost entirely—" explained his companion. "—they were much stronger than those of your wives—"

Lazarus did not bother to explain that he and the captain were not married. "—there was not time to

simulate the appearance and colors your thoughts showed—does it matter much to you?"

Lazarus explained gravely that it mattered very little.

He had considerable difficulty, on returning to the base, in convincing others of the seriousness of his report.

THE PICNIC stretched into days and on into weeks. After the months shut up in the ship, sleeping or working, the temptation to take a vacation was strong and there was no need to resist it. Food, clothing, and shelter—what were these? Food in abundance, ready prepared and easy to handle, grew near at hand. The water of the streams was potable. As for clothing, they had plenty if they needed it, but the need was esthetic rather than utilitarian—clothing for protection would have been as redundant as socks on a rooster. For ornamentation, let those who cared for the trouble of robes wear them; bracelets and beads and flowers in the hair would do for the rest, and were not nearly as much nuisance in case one pleased to take a dip in the sea.

Lazarus stuck to his kilts.

The culture and the degree of enlightenment of the Little People was difficult to understand all at once, because it was subtle. Since they lacked the outward signs, in Earth terms, of high scientific development—no great buildings, no complex mechanical transportation devices, no throbbing power plants—it was easy to be trapped into the assumption that they were simply Mother Nature's children, living in a Garden of Eden.

One eighth of an iceberg shows above water; the rest is concealed.

Their knowledge of physical science was not inferior to that of the

colonists; it was incredibly superior. They toured the ship's boats with polite interest, but confounded their guides by inquiring why things were done in *this* way rather than *that*—and the way suggested invariably proved to be simpler and superior in efficiency to the Earth technique, when the Earth technicians could understand what they were driving at!

They understood machinery and all that machinery implies, but they simply had little use for it. They had no need for machinery for communication—obviously!—little need for it for transportation, though the reason for that was not immediately evident, and very little need for it in any of their activities. When they had a specific need for a mechanical contrivance they were quite capable of inventing it, building it, using it once, and destroying it, performing the whole process with a degree of co-operation quite foreign to men.

It was in the field of biology, in the arts of life, that their preëminence was most startling. They were masters in the manipulation of life forms. The development of plants in a matter of days which bore fruit duplicating the nutritive qualities *and* flavor values of a varied Earth diet represented a minor routine task to them; any of their manipulative biotechnicians could achieve it as easily as a human horticulturist could breed for a certain strain of color or shape in a flower.

But the methods would be different. Be it said for the Little People that they tried to explain to biologists among the Families their methods, but the explanation did not come through. In gross terms, they claimed to *think* a plant into the shape and character they desired. Inadequate as that description must

be, it is none the less true that they could take a dormant seedling plant and, without touching it or operating on it in any perceptible way, cause it to bloom and burgeon into maturity within the space of a few hours *and having new characteristics not found in the parent line*. The plant would, thereafter, breed true to its acquired character.

NEVERTHELESS, with respect to scientific advancement, the Little People differed from Earthmen only in degree. In an utterly basic sense, they differed from them in kind.

The Little People were not individuals.

That is to say, no single body of a native housed a discreet individual. Individuals were multibodied, had group "souls." The basic unit of their society was a telepathic rapport group of many parts. The number of bodies and brains housing one individual ran as high as ninety or more, was never less than thirty-odd.

The colonists found much that was utterly puzzling about the behavior of the Little People before this simple fact came out. There is reason to believe that the Little People found the Earthmen equally puzzling, that they, like the Earthmen, had assumed that their own pattern of existence was mirrored in the others. The revelation of the true facts, brought about by mutual misunderstandings over identity, seemed to arouse horror in the minds of the Little People. They withdrew from the neighborhood of the settlement of the Families, and remained away for several days.

At length a messenger entered the camp site and sought out King. "—we are sorry that we shunned you—we, in our haste, mistook your misfortune for your fault—we wish to help you—we offer our help that



"That—thing—may be more efficient, but it is not a human baby any more. We've got to go—" Long groaned.

you may become like ourselves—"

King pondered how to answer the overture. "We thank you for your wish to help us," he said, "but what you call our misfortune seems to be the way we are constituted. Our ways are not your ways; we would not understand your ways."

The thought that came back to him was troubled. "—we have aided

the beasts of the air and the ground to cease their strife—but if you do not wish our help we will not thrust it on you—"

The messenger went away, leaving King troubled in his mind. Perhaps, he thought, he had been hasty in refusing without consulting others among the elders. Telepathy was not a gift to be scorned; perhaps the

Little People could have led them to telepathy without any loss of their human individualism. But his knowledge of the few sensitives among the Members did not encourage the hope; there was not a one of them who was emotionally stable, most were mentally deficient, as well. Later, he thought; no need to hurry.

"No need to hurry" was the spirit which obtained throughout the settlement. There was so little need to strive, so little that needed to be done; the sun was warm and pleasant, each day was so much like the next, and there was always the day after that. The Members, predisposed by their inheritance to take a long view of things, began to take an eternal view in the sense that time no longer mattered. Even the longevity research, which had continued longer than the memory of any of them, languished. Master Gordon Hardy, in charge of the research, tabled his current experimentation to pursue the vastly more fruitful occupation of learning from the Little People what they knew of the nature of life. He was forced to take it in easy doses, spending long hours in digesting his newly acquired knowledge. As time trickled on he was hardly aware that his periods of contemplation were becoming longer, his bursts of active study less frequent. One thing he did learn; its implications opened up whole new fields of thought—the Little People had, in a sense, conquered death.

Since with them the ego was distributed through many bodies, the death of one body involved no discontinuity of the ego; the memory experiences of that body remained intact, the personality associated with it was undamaged, and the physical loss could be made up by birth, or by young persons from

other groups "marrying" into the group. But the group egos, the personalities which spoke to the Earthmen, were not born, nor could they die, save by destruction of every member of a group. They simply went on, apparently forever.

It seemed that their young, up to the time of "marriage" or assimilation, had little individual personality and only rudimentary thought processes. Their elders expected no more of them in the way of intelligent behavior than Earthmen expect of a child in the womb. There were many such attached to each ego group; they were cared for like dearly beloved pets, although they frequently were as large and as mature to Earth eyes as their elders.

LAZARUS grew bored more quickly than the majority of his cousins.

"It can't always," he explained to Libbey, lying by his side on the fine grass, "be time for tea."

"What's your rush, Lazarus?"

"No rush." Lazarus set the point of his knife on his left elbow, flipped it with his right hand, watched it bury its point in the ground, and continued, "It's just that this place reminds me of a well-kept zoo. It's got about as much future."

"Why worry about the future? This is the future."

"It's 'Never-Never Land!'"

"What's worrying you?"

"Nothing. That's what worries me. Honest to goodness, Andy, don't you see anything wrong with being turned out to pasture like this?"

Libbey grinned sheepishly. "I guess it's my Arkansas blood. 'When it don't rain, the roof don't leak; when it rains, I can't fix it,'" he quoted. "What irks you?"

"Well—" Lazarus' pale-blue eyes stared far away, he paused his play

with the knife. "When I was a young man a long time ago I was beached in the South Seas—"

"Hawaii?"

"No. Damned if I know what the name of the place is now. I got hard up, mighty hard up, and sold my sextant. Pretty soon—or maybe after a long time—I could 'a' passed for a native. It didn't seem to matter. But one day I caught a look at myself in a mirror.

"I beat my way out of that place being shipmate to a cargo of green hides, which may give you some idea of how anxious I was to leave."

Libbey did not answer. "What do *you* do with your time, Lib?" Lazarus persisted.

"Same as always. Think about mathematics. Try to figure out a dodge for a space drive like the one that got us here."

"Any luck on that?" Lazarus was suddenly alert.

"Not yet. Gimme time. Or I just watch the clouds integrate. There are amusing mathematical relationships everywhere if you are interested in them. In the ripples on the water, or the shapes of heads—elementary fifth-order functions."

"Huh? You mean fourth order."

"Fifth order. You omitted the time variable. I like fifth-order equations," he said dreamily. "You find 'em in fish, too."

"Hum-mph!" said Lazarus. He stood up. "That may be all right for you, but it's not my pigeon."

"Going some place?"

"Goin' to take a walk."

LAZARUS set out to the north, that being the direction of the nearest high latitudes. He walked the rest of that day, slept the night, and was up and moving on at dawn. The next day was followed by another like it, and that by another. The

going was easy, much like strolling in a park. Too easy, in Lazarus' opinion. For the sight of a volcano, or a really major waterfall, he felt willing to offer fifty cents and throw in a jackknife!

The food plants were sometimes strange, but abundant and satisfactory. He met occasional representatives of the Little People, going about their mysterious affairs. They did not bother him nor interfere with him, but greeted him friendly and with a complete assumption of previous acquaintanceship. He began to long for one who would be a stranger; he felt watched.

Presently the nights grew cooler, the days less balmy, and the Little People less omnipresent. When he had not seen one for an entire day he camped for the night, remained there the next day—took out his soul and examined it.

He had to admit to himself that he could find no fault with the planet nor with its inhabitants, but just as definitely it was not to his taste. No philosophy that he had ever read or listened to gave any reasonable cause for man's existence, nor any rational clue to his proper conduct. Basking in the sun seemed to be as good a thing to do as any other; nevertheless, it was not for him, and he knew it, even if he did not know why he knew it.

The hegira of the Families had been a mistake. They should have stayed, even if it meant fighting. They had fled across half a universe—Lazarus was careless about his magnitudes—looking for a place to light. They had found one, already occupied, by beings so superior to them as to be intolerable, yet so indifferent to them they had not even bothered to exterminate them, but had whisked them away to this—this overmanicured country club.

And that in itself was a humiliation. The *New Frontiers* represented the culmination of five hundred years of human scientific research, the best that man could conceive; it had been flicked across the deeps of space as casually as man might restore a fledgling bird to a nest.

The Little People showed no tendency to kick them out, yet the Little People had a demoralizing effect on men, he could see. Individually, they might be morons, but collectively, each rapport group constituted a genius which threw the best minds the Earthmen had to offer into the shade. Human beings could not hope to compete with that type of organization any more than a back-room shop can compete with a factory assembly line. Yet to surrender to any such group identity, even if they could, would be, he felt sure, to give up whatever it was that made them men.

He admitted his prejudice in favor of men. He *was* a man.

The uncounted days slid past while he conferred with himself over the matters that bothered him—problems that had made sad the soul of his breed since the first ape man had risen to self-awareness, questions not solved by a full belly nor fine machinery. And the endless quiet days did no more to give him final answers than did all the soul searchings of his ancestors. Why? What shall it profit a man? No answer came back—save one, a firm, unreasoned conviction that he was not intended for, or not ready for, this timeless snug harbor of ease.

His troubled reveries were interrupted by the appearance of one of the Little People. “—greetings, old friend—your leader, King, wishes you to return to your home—he has need of your advice—”

“What’s the trouble?” Lazarus demanded.

But the little creature could not or would not tell him. Lazarus gave his belt a hitch and headed south. “—there is no need to go so slowly now—” came a thought after him.

Lazarus let himself be led to a clearing beyond a clump of trees. There he found an egg-shaped object, perhaps six feet long, featureless except for a door in the side. The native entered through the door, Lazarus squeezed his larger bulk in after him; the door closed.

It opened almost at once. Lazarus saw that they were on the beach below the settlement. He had to admit that it was a good trick.

LAZARUS HURRIED to the ship’s boat still parked on the beach and in which King maintained a semblance of community headquarters. He sought out King. “You sent for me, skipper. What’s up?”

King’s austere face was grave. “It’s about Mary Risling.”

Lazarus felt a sudden cold tug at his heart. “Dead?”

“No. Not exactly. She’s gone over to the Little People. ‘Married’ into one of their groups.”

“What? Why, that’s impossible!”

But it *was* possible. There was no faint possibility of interbreeding between Earthmen and the natives in any biological sense, but there existed no real barrier, if sympathy existed, to a human merging into one of their rapport groups, drowning his personality in the ego of the many.

Mary Risling, moved by conviction of her own impending death, saw in the deathless group egos a way out. In a sense, faced with the inescapable conflict between life and death, she had sought to choose neither by choosing nirvana—selflessness. She had found a group which

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was willing to receive her; she had crossed over.

"It raises a lot of problems," concluded King. "With Ford still on the sick list, both Zaccur and I felt that you had better be here."

"Yes, yes, but where is Mary?" Lazarus demanded, and charged out of the room without waiting for an answer. He ran through the settlement, ignoring greetings and attempts to stop him alike. Near the edge of the camp he encountered a native. He stopped.

"Where's Mary Risling?"

"—I am Mary Risling—"

"For the love of— You *can't* be."

"—I am Mary Risling and Mary Risling is myself—do you not know me, old friend?—I remember you—"

Lazarus waved his hands. "No! I want to see the Mary Risling who looks like an Earthman—like me."

The native paused uncertainly, then indicated "—follow me, then—"

He found her some distance away from the camp. It was quite obvious that she had been avoiding the other colonists. "Mary!"

She answered him mind to mind, "—I am sorry to see you so troubled—Mary Risling is gone except in that she is part of us—"

"Oh, come off that, Mary! Don't give me that stuff! Don't you *know* me?"

"—of course I know you, old friend—it is you who does not know *me*—do not trouble your soul and grieve your heart with the sight of the body before you—I am not one of your kind—I am native to this planet—"

"Mary," he said insistently, "you've got to undo this. You've got to come out of there!"

She shook her head, an oddly human gesture, for the face no longer held any trace of human expression; it was a mask of otherness. "—that

is impossible—Mary Risling is gone—the one who speaks with you is inextricably *myself*, and not your kind—" The creature who had been Mary Risling turned and walked away.

"Mary!" he cried. His heart leaped across the span of centuries to the night his mother had died. He covered his face with his hands and wept with the uncomplicated, inconsolable grief of a child.

LAZARUS found both King and Barstow waiting for him when he returned from the meeting with "Mary Risling." King studied his face. "I could have saved you that," he said slowly, "but you would not wait."

"Forget it," Lazarus answered shortly. "What do we do now?"

"There is something else you must see before we discuss it," said Zaccur Barstow.

"What?"

"Never mind. Come and see." They led him back into the ship's boat in which King maintained his headquarters, and to a compartment which was, in opposition to Family custom, locked. There was a woman therein, who, on seeing the three men, quietly withdrew, locking the door behind her again as she left.

"Take a look at that," said Barstow briefly.

"That," was an object in an incubator, a living creature, a child—but no such child had ever been seen before. Lazarus stared.

"What the devil is it?" he demanded.

"See for yourself. Go ahead—touch it. You won't hurt it."

Lazarus did so, gingerly at first, then with returning confidence. What it was he could not say; it was not human, nor was it like the offspring of the Little People. Did

this planet, like the last, contain some other previously unsuspected race? It was manlike, yet not a man. It lacked even the button nose of a child, nor were there evident external ears. There were organs of some sort in the usual locations of each, but flush with the skull and protected with bony ridges. The hands had too many fingers; there was a larger extra one attached near the wrist which ended in a cluster of pink worms.

There was something odd about the torso of the child which Lazarus could not place. But two other facts were evident: The legs ended, not in human feet, but horny, toeless pediments—hoofs. And the infant was hermaphroditic, not in deformity but in healthy development.

"What is it?" he repeated, his mind filled with lively suspicion.

"That," said Zaccur, "is Marion Schmidt, born three weeks ago."

"Huh? What do you mean?"

"It means that the Little People are just as clever in manipulating us as they are in manipulating plants."

"What? But they agreed to leave us alone!"

"Don't blame them entirely. We let ourselves in for it. The original idea was a few improvements."

"Improvements! That thing's an obscenity."

"Yes and no. I agree with you emotionally, but as a matter of fact it's . . . it's a sort of a superman. Its body architecture has been re-designed for greater efficiency, the useless simian hangovers have been eliminated, and its organs rearranged in a more common-sense fashion. See that odd appendage to the hand? That is a second tiny hand, backed up by a microscopic eye—a good notion, once you get used to it.

"But I agree that it does look horrid—to me."

"It'd look horrid to anybody," Lazarus stated. "It may be more efficient, but damn it, it ain't human."

"No, it's not. And it creates a problem."

"I'll say it does! Wait a minute. You say it has a second set of eyes in its hands? That doesn't seem possible."

Barstow shrugged. "I'm no biologist. But we know that every cell in the body contains its bundle of chromosomes with a full set of genes. If one knew how to manipulate them, I suppose one could grow eyes or bones, or anything else, anywhere one liked."

"I don't want to be manipulated!"

"Neither do I."

LAZARUS stared out over a full meeting of the Families, gathered on the broad beach. "I am—" he started formally, then looked puzzled. "Come here a moment, Libbey," he whispered, and bent to his ear. Libbey nodded and whispered back. "Oh," said Lazarus, and turned back to the crowd.

"I am two hundred and forty-one years old," he stated. "Is there anyone here who is older?" It was a mere formality; he knew that he was eldest—he felt twice that old. "The meeting is opened," he added. "Who is your chairman?"

"Get on with it," someone called from the crowd.

"Very well," said Lazarus. "Zaccur Barstow!"

"Zaccur Barstow, speaking for myself. Some of us have come to believe that this planet, pleasant as it is, is not the place for us. You know the case of Mary Risling, and have had a chance to view the stereos of Marion Schmidt; I need speak no further. The question of further emigration arises. Lazarus Long

proposes that we return to Earth. In such—" His words were drowned out by noise from the crowd.

Lazarus shouted them down. "I might as well speak for myself now," he said. "Nobody is going to be forced to leave. But if there are enough of you who would like to leave to justify taking the ship, I say go back to Earth. Maybe you would like to go look for still another planet instead—that's still to be decided. But first, are there any who think as I do about leaving?"

"I do!" came a shout. It was echoed by others. Lazarus tried to pick out the man who had responded first. "Go ahead, bud," he directed, pointing to him.

"Name of Oliver Schmidt. I've been waiting for months for somebody to suggest this idea. I thought I was the only sorehead in the Families. I haven't any real reason to offer for leaving—I'm not scared out by the Mary Risling matter, nor the case of Marion Schmidt. Anybody who regards such things as 'improvements' is welcome to try them. But I've got a deep-down urge to see Cincinnati again. I'm fed up with this place. I'm tired of being a lotus eater. Damn it, I want to *work* for my living. According to the Families' geneticists, I ought to be good for another century, anyhow. I can't see spending that long lying in the sun and daydreaming."

When he subsided, at least two hundred more signaled their desire to talk. "Easy! Easy!" shouted Lazarus. "If you are all going to try to talk, you'll have to speak through your family representatives." He singled out another speaker.

"I won't take long," the speaker said, "as I agree with Oliver Schmidt. I just wanted to mention my own

reason. Do any of you miss the Moon? Back home I used to sit out on my balcony on warm summer evenings and smoke and look at the Moon. I didn't know it was important to me, but it is. I want a planet with a moon."

The third speaker said only, "This Mary Risling case has given me the willies. I get nightmares thinking I've done it myself."

The argument went on and on. The objection was raised that they had been chased off the Earth; how could they be sure of being allowed to return? Lazarus answered that himself: "We gained one advantage by running into the Jockaira first and now into the Little People. We've made progress in the physical sciences that puts us way ahead of anything we ever dreamed of before. We can go back to Earth loaded for bear. We'll be in shape to demand living room; we'll be strong enough to defend ourselves."

"Lazarus Long—" came another voice.

"Yes," acknowledged Lazarus. "Go ahead."

"I am too old to make any more cosmic jumps from star to star, and much too old to engage in war at the end of such a jump. Whatever the rest of you do, I am staying."

"In that case," said Lazarus, "there is no need to discuss it, is there?"

"I am entitled to speak."

"All right, you've spoken. Sit down and give someone else a chance."

THE SUN dropped out of sight and the stars started to come out. Lazarus knew that the talk would never end unless he did something to end it. "All right," he said, "let's find out where we stand. Everybody that wants to go back to Earth get

way over to the right. Everybody who is going to stay here move over to the left. Everybody who wants to leave, but favors going exploring again, gather together in the middle."

Slowly, with the maddening deliberation of crowds, they sorted themselves out. Little knots of people still engaged in argument obstructed the movement, but gradually the division took shape.

On the left, about a tenth of the total Members were gathered together, signifying thereby their intention of remaining. They were mostly the old and the tired, whose sands were running low. There were a few youngsters who had never seen Earth. In the center there was a small group, mostly men and some of the younger women, not over three hundred, who voted to go seeking

new frontiers. But the great mass was gathered on the right.

He could see new animation in their faces; it lifted up his heart. He had been bitterly afraid that he was nearly alone in his homesickness.

While they stood there the group in the center began to melt. It was evident to everyone that they were heavily outvoted; they began to choose from the two possible alternatives. A few, a very few, drifted hesitantly over to the left; the rest broke off, and by ones and twos and threes joined the group on the right. When this secondary division was completed, Lazarus turned to the group on the left. "Very well," he said, "you—old folks might as well go back up to the meadows and get your sleep. The rest of us have got plans to make."

Lazarus gave Libbey the floor and

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let him explain to the crowd that the trip would not be the interminable business that the first flight from Earth had been, nor even the comparatively long second jump. He modestly placed the credit where it belonged—with the Little People. They had straightened out his difficulties in dealing with the problem of drive at speeds in excess of light. If they knew what they were talking about—and Libbey was sure they did—there appeared to be no limits to what Libbey chose to call “para-acceleration.” “Para” because, like Libbey’s own light-pressure drive, the action was uniform throughout the affected mass and was, therefore, not perceptible through the senses.

Lazarus gently cut him short. “That’s your department, son, and everybody trusts you in it. We aren’t qualified to discuss the fine points.”

“I was only going to add—”

“I know. But you were already out of the world when I stopped you.”

Libbey was asked one more question. “When do we get there?”

“I don’t know,” admitted Libbey, thinking of the question in the way Nancy Weatheral had put it to him long ago. “I don’t know what year it will be, but it will seem like about three weeks.”

THE TAKE-OFF was unspectacular. Those remaining behind had largely avoided the rest during the preparations. A coolness had grown up between the two groups; the division on the beach had split friendships, had even broken up contemporary marriages, had left hurt feelings, irresolvable bitternesses.

The parents of the mutant Marion Schmidt elected to remain behind—most happily, for it made it easy to leave the mutant behind.

Shortly before the last ship’s boat was to raise ground, Lazarus felt his elbow touched. He turned and found himself confronted by a young man. “Excuse me,” the young chap said, “my name’s Hubert Johnson. I want to go along, but I’ve had to stay with the other crowd to keep my mother from throwing fits. If I show up at the last minute, can I go along?”

Lazarus looked him over. “You look old enough to decide without asking me.”

“You don’t understand. I’m an only child, and my mother tags me around. I had to slip away to—”

“Get in the boat,” said Lazarus. “You’ll never break away any younger.”

The young man did so, with one worried backward glance toward the bank. There was a lot, thought Lazarus, to be said for ectogenesis.

Lazarus reported in to King in the control room. “All aboard?” asked King.

“All aboard. One more passenger at the last possible moment. Woman called Eleanor Johnson. Let’s go.”

“Let’s go!”

The stars blinked out almost at once. They flew blind, with nothing but Slipstick Libbey’s incomprehensible talent to guide them. If he had any doubts as to his ability to lead them through the featureless blackness and bring them out somewhere near the Sun he kept his misgivings to himself.

On the twenty-third day, ship’s time, of the trip and the eleventh day of para-deceleration, the stars reappeared, all in their old familiar ranges—the Big Dipper, mammoth Orion, the silver circle of the Northern Crown, the sickle of Leo, lopsided Crux, the fairy Pleiades—and dead ahead of them, blazing like a searchlight against the frosty back-

drop of the Milky Way, was a luminary that had to be the Sun.

Lazarus had tears in his eyes for the second time in a single month.

It was impractical simply to rendezvous with Earth, establish a parking orbit and land. Figuratively speaking, they had to throw their hats in first and wait to see what happened. Furthermore, the question of time, of *date*, must first be settled. Libbey was able to establish, by examination for proper motion displacement of near stars, that the date was not later than 3700 A. D., and might just as well still be in the twenty-second century. Closer than that he refused to commit himself, lacking the precision instruments of a proper observatory. But as soon as the ship was close enough to make out planets, he would have the clock of the Solar System itself to read, a clock with nine hands—think of Pluto as the hour hand, Jupiter as the minute hand, and Mercury as the second hand.

For any particular arrangement of those hands one, and only one, date is possible. Pluto's dead crawl split the problem up into fifteen possible answers, two hundred fifty years apart. But Neptune's period is cantankerously different from that of Pluto; the two planets fall back into relatively the same arrangement with accuracy to two significant figures but once in seven hundred and fifty-eight years. The astrogational instruments of the *New Frontiers* were good for greater accuracy than that; using only three significant figures, Pluto and Neptune assume the same configuration with respect to the Sun and the stars only once in more than twenty-two thousand five hundred years.

Pluto and Neptune alone gave definite answer thus of the urgent

question of date, when the eon had first been fixed by the stars. Q. E. D. It remained only to check the answer against the other planets. "This problem," Libbey grouched to Lazarus, "has no proper solution. It involves a set of infinities. You know as well as I do that 'infinity' is a question-begging term."

"That's looking at it the hard way," said Lazarus. "You can get a practical answer, can't you? Seems to me I could."

"Of course I could," Libbey answered him. "Didn't I just tell you?"

"You did not! Damn it, man—*what year is it?*"

"Let's answer it this way," said Libbey: "The time rate in the ship and the time rate on Earth have been one and the same."

Lazarus heaved a sigh—he had been wondering if Earth would still be recognizable, afraid they might have torn down New York, for example. "Shucks, Lib, you shouldn't 'ave scared me like that."

That was that; for Libbey there remained only the more interesting problem of inventing a mathematics which would serve to describe two apparently irreconcilable groups of facts, the Michelson-Morley experiments and the log of the *New Frontiers*. He set happily about it.

THEY THREW the ship into a temporary orbit half a billion miles from the Sun and with a radius vector approximately at right angles to the plane of the ecliptic. Parked thus outside the flat pancake of the Solar System, they were safe from the long chance of surprise by another vessel. A ship's boat had been outfitted with the neo-Libbey drive; a scouting party was sent down in it.

Lazarus wanted to go; King refused him permission, which sent

Lazarus into something close to the sulks. Ralph Schultz went, since psychological factors would be all important in the report—even more important than the co-ordinate report on the Federation's advances in military technology. It would not be feasible to devise weapons and methods of fighting with the aid of their new knowledge until they knew what they were to fight *against*, but it was imperative first to know whether or not it would be necessary to fight. The elders had a tentative plan under which they would demand the retrograded and thinly settled continent of Europe for the exclusive use of the Families and their descendants, but it was quite possible that the Federation had taken it over in their absence, recivilized and resettled it.

Again there was nothing to do but wait.

Lazarus endured the wait in a condition of nail-chewing uncertainty which ruined his appetite. He had maintained publicly to the Meeting of the Families that the scientific advantages they possessed gave them a decisive advantage over the military forces of the Federation; privately, he admitted to himself that the argument was utter sophistry. Knowledge alone was not sufficient in warfare. History proved otherwise. The ignorant fanatics of Europe had defeated the incomparably more civilized Mohammedan "infidels"; Archimedes had been struck down by a common soldier. Libbey, or someone, might be able to devise a weapon which the Federation could not defeat—again he might not. And how were they to know what strides in offensive warfare had been achieved on Earth?

King, navy man by profession, saw the problem even more vividly, and was obsessed by the further haz-

ard of the personnel he had to work with. The Members were anything but the seasoned fighters he had been accustomed to command. The mere prospect of trying to whip the Families into some semblance of an efficient fighting unit was enough to break him out of sleep in a cold sweat.

The doubts and fears which consumed them each kept carefully to himself, fearful that to speak of them would be to spread a poison of fear through the ship. They spoke of anything else, but not of that which was uppermost in their minds. Nor were they alone in it; half the ship's company was aware of the weakness of their position, but they kept silent because the bitter resolve to go *home* made them willing to accept the dangers.

"I wonder," Lazarus said to King—his pique at being left behind long since forgotten—"how they will feel about the *New Frontiers* herself."

"What do you mean?"

"Well—we highjacked it."

"Bless me, so we did! Do you know, it's been so long ago it's hard for me to realize that she was ever anything but my ship, or that I first came into her through an act of piracy." He looked thoughtful. "Do you suppose that Ford will be connected with the matter? That would be hard lines after all he has been through. Hm-m-m. How is he now?"

"Schultz calls it a complete recovery. Of course, he doesn't remember his experience, but Schultz calls that a normal healthy accommodation."

THE scouting party was two days late. No signal was received from them until just before rendezvous, since the scouting craft traveled relative to the ship at greater than signal speed; i. e., speed of light. But while they were slowing to rendez-

vous, King received Ralph Schultz's face on the control-room screen. "Hello, captain! We'll be boarding shortly to report."

"Give me a summary now!"

"I wouldn't know where to begin. But it's all right—we can go home!"

"Huh? How's that? Repeat!"

"Everything's all right. We are restored to the Covenant. You see, there isn't any difference any more. *Everybody is a Member of the Families now.*"

"What do you mean?" King demanded.

Shortly thereafter, Schultz was explaining to as many of the elders as could crowd into King's cabin. "—so they picked up our research where we left off," he was saying, "and pushed it ahead with a thousand times the facilities we had. They had our antisenescence techniques as a starter, and that gave them a real boost. Anyhow, they established that heredity, *biological* heredity, had very little to do with it. It helped, but *psychological* heredity was much more important. A man could live a long time just by believing that he was bound to live a long time and thinking accordingly—"

"Shucks," said Lazarus, "I could have told them that."

"The mechanism is insufficient," protested Master Gordon Hardy. "Mere self-confidence could never be—"

"Let me finish," Schultz cut in on him. "I didn't say that was all. That simply helps a man to live as long as he can. They located the controlling factor that establishes the limit. It's tied up in the radioactive qualities of certain of the so-called vitamins and—"

"What ones? And what isotopes?" demanded Hardy.

"Will you let me finish?" Schultz pleaded. "I'm no biotechnician; I can't give you details. I've brought

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along sixteen spools for you to study."

"Where are they?"

"Shut up," said King.

"Under a normal diet," Schultz resumed, "the maximum possible life-time seems to be about four hundred years. Never achieved, but possible. But since we can tailor any radioactive isotope we want nowadays, the normal maximum can be moved up indefinitely. Five hundred years, a thousand years, no real reason to die at all!"

There was silence while it soaked. "Then we can go home," King said, half to himself.

"Certainly. There's no animosity toward us. The reason for it is gone."

"How about us stealing the ship?" asked Lazarus. "Did you square that?"

"That? Hell, man, nobody cares about that. It was designed so somebody could make an interstellar trip. We did it. We made an interstellar trip and came back. They've got their tongues hanging out, waiting to give us a reception. Brass bands and fatted calves!"

"Well," said Lazarus, "what are we waiting for?"

"We're not," snapped King. "Libbey, up to the control room! Lazarus, you come with me." He left the room unceremoniously, Lazarus close behind him. Lazarus was whistling an archaic tune; its words would have been unfamiliar to most of the others:

"—*here I come!*

Right back where I started from!"

He was not thinking of the great reception that awaited them. He was thinking of a little Mexican restaurant in Dallas where they used to serve the best chili and beans he had ever tasted. He was wondering if they still did.

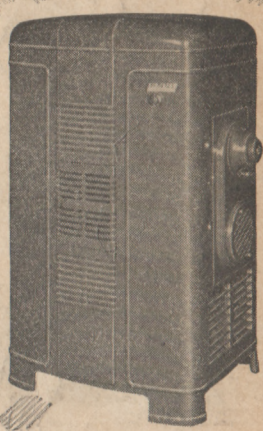
He intended to find out.

THE END.

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