

Book 3

Surface Tension

Prologue

Dr. Chatvieux took a long time over the microscope, leaving la Ventura with nothing to do but look at the dead landscape of Hydrot. Waterscape, he thought, would be a better word. From space, the new world had shown only one small, triangular continent, set amid endless ocean; and even the continent was mostly swamp.

The wreck of the seed-ship lay broken squarely across the one real spur of rock which Hydrot seemed to possess, which reared a magnificent twenty-one feet above sea-level. From this eminence, la Ventura could see forty miles to the horizon across a flat bed of mud. The red light of the star Tau Ceti, glinting upon thousands of small lakes, pools, ponds and puddles, made the watery plain look like a mosaic of onyx and ruby.

"If I were a religious man," the pilot said suddenly, "I'd call this a plain case of divine vengeance."

Chatvieux said: "Hmn?"

"It's as if we'd been struck down for it *hubris*? Pride, arrogance?"

"*Hybris*," Chatvieux said, looking up at last. "Well, is it? I don't feel swollen with pride at the moment. Do you?"

"I'm not exactly proud of my piloting," la Ventura admitted. "But that isn't quite what I mean. I was thinking about

why we came here in the first place. It takes a lot of arrogance to think that you can scatter men, or at least things very much like men, all over the face of the galaxy. It takes even more pride to do the job to pack up all the equipment and move from planet to planet and actually make men, make them suitable for every place you touch."

"I suppose it does," Chatvieux said. "But we're only one of several hundred seed-ships in this limb of the galaxy, so I doubt that the gods picked us out as special sinners." He smiled. "If they had, maybe they'd have left us our ultra-phone, so the Colonization Council could hear about our cropper. Besides, Paul, we don't make men. We adapt them to Earthlike planets, nothing more than that. We've sense enough or humility enough, if you-tike-tfest" better to know that we can't adapt men to a planet like Jupiter, or to the surface of a sun, like Tau Ceti."

"Anyhow, we're here," la Ventura said grimly. "And we aren't going to get off. Phil tells me that we don't even have our germ-cell bank any more, so we can't seed this place in the usual way. We've been thrown onto a dead world and dared to adapt to it. What are the pantropes going to do with our recalcitrant carcasses provide built-in waterwings?"

"No," Chatvieux said calmly. "You and I and all the rest of us are going to die, Paul. Pantropic techniques don't work on the body; that was fixed for you for life when you were conceived. To attempt to rebuild it for you would only maim you. The pantropes affect only the genes, the inheritance-carrying factors. We can't give you built-in waterwings, any more than we can give you a new set of brains. I think we'll be able to populate this world with men, but we won't live to

see it."

The pilot thought about it, a lump of cold blubber collecting gradually in his stomach. "How long do you give us?" he said at last.

"Who knows? A month, perhaps."

The bulkhead leading to the wrecked section of the ship was pushed back, admitting salt, muggy air, heavy with carbon dioxide. Philip Strasvogel, the communications officer, came in, tracking mud. Like la Ventura, he was now a man without a function, and it appeared to bother him. He was not well equipped for introspection, and with his ultraphone totally smashed, unresponsive to his perpetually darting hands, he had been thrown back into his own mind, whose resources were few. Only the tasks Chatvieux had set him to had prevented him from setting like a gelling colloid into a permanent state of the sulks.

He unbuckled from around his waist a canvas belt, into the loops of which plastic vials were stuffed like cartridges. "More samples. Doc," he said. "All alike water, very wet. I have some quicksand in one boot, too. Find anything?"

"A good deal, Phil. Thanks. Are the others around?"

Strasvogel poked his head out and hallooed. Other voices rang out over the mudflats. Minutes later, the rest of the survivors of the crash were crowding into the pantrope deck: Saltonstall, Chatvieux' senior assistant, a perpetually sanguine, perpetually youthful technician willing to try anything once, including dying; Eunice Wagner, behind whose placid face rested the brains of the expedition's only remaining ecologist; Eleftherios Venezuelos, the always-silent delegate from the Colonization Council; and Joan Heath, a midshipman whose duties, like la Ventura's and Phil's, were now without meaning, but whose bright head and tall, deceptively indolent body shone to the pilot's eyes brighter than Tau Ceti brighter, since the crash, even than the home sun.

Five men and two women to colonize a planet on which "standing room" meant treading water.

They came in quietly and found seats or resting places on the deck, on the edges of tables, in corners. Joan Heath went to stand beside la Ventura. They did not look at each other, but the warmth of her shoulder beside his was all that he needed. Nothing was as bad as it seemed.

Venezuelos said: "What's the verdict, Dr. Chatvieux?"

"This place isn't dead," Chatvieux said. "There's life in the sea and in the fresh water, both. On the animal side of the ledger, evolution seems to have stopped with the Crustacea; the most advanced form I've found is a tiny crayfish, from one of the local rivulets, and it doesn't seem to be well distributed. The ponds and puddles are well-stocked with small metazoans of lower orders, right up to the rotifers including a castle-building genus like Earth's *Floscularidae*. In addition, there's a wonderfully variegated protozoan population, with a dominant ciliate type much like *Pammoecium*, plus various Sarcodines, the usual spread of phyto-flagellates, and even a phosphorescent species I wouldn't have expected to see anywhere but in salt water. As for the plants, they run from simple blue-green algae to quite advanced thallus-producing types though none of them, of course, can live out of the water."

"The sea is about the same," Eunice said. "I've found some of the larger simple metazoans jellyfish and so on and

some crayfish almost as big as lobsters. But it's normal to find
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salt-water species running larger than fresh-water. And there's the usual plankton and nannoplankton population."

"In short," Chatvieux said, "we'll survive here if we fight."

"Wait a minute," la Ventura said. "You've just finished telling me that we wouldn't survive. And you were talking about us, the seven of us here, not about the genus man, because we don't have our germ-cells banks any more. What's"

"We don't have the banks. But we ourselves can contribute germ-cells, Paul. I'll get to that in a moment." Chatvieux turned to Saltonstall, "Martin, what would you think of our taking to the sea? We came out of it once, long ago; maybe we could come out of it again on Hydrot."

"No good," Saltonstall said immediately. "I like the idea, but I don't think this planet ever heard of Swinburne, or Homer, either. Looking at it as a colonization problem alone, as if we weren't involved in it ourselves, I wouldn't give you an Oc dollar for *epi oinopa ponton*. The evolutionary pressure there is too high, the competition from other species is prohibitive; seeding the sea should be the last thing we attempt, not the first. The colonists wouldn't have a chance to learn a thing before they'd be gobbled up."

"Why?" la Ventura said. Once more, the death in his stomach was becoming hard to placate.

"Eunice, do your sea-going Coelenterates include anything like the Portuguese man-of-war?"

The ecologist nodded.

"There's your answer, Paul," Saltonstall said. "The sea is out. It's got to be fresh water, where the competing creatures are less formidable and there are more places to hide."

"We can't compete with a jellyfish?" la Ventura asked, swallowing.

"No, Paul," Chatvieux said. "Not with one that dangerous. The pantropes make adaptations, not gods. They take human germ-cells in this case, our own, since our bank was wiped out in the crash and modify them genetically toward those of creatures who can live in any reasonable environment. The result will be manlike, and intelligent. It usually shows the donors' personality patterns, too, since the modifications are usually made mostly in the morphology, not so much in the mind, of the resulting individual."

"*But we can't transmit memory.* The adapted man is worse than a child in the new environment. He has no history, no techniques, no precedents, not even a language. In the usual colonization project, like the Tellura affair, the seeding teams more or less take him through elementary school before they leave the planet to him, but we won't survive long enough to give such instruction. We'll have to design our colonists with plenty of built-in protections and locate them in the most favorable environment possible, so that at least some of them will survive learning by experience alone."

The pilot thought about it, but nothing occurred to him which did not make the disaster seem realer and more intimate with each passing second. Joan Heath moved slightly closer to him. "One of the new creatures can have my personality pattern, but it won't be able to remember being me. Is that right?"

"That's right. In the present situation we'll probably make

our colonists haploid, so that some of them, perhaps many, will have a heredity traceable to you alone. There may be just the faintest of residuums of identity pantropy's given us some data to support the old Jungian notion of ancestral memory. But we're all going to die on Hydrot, Paul, as self-conscious persons. There's no avoiding that. Somewhere we'll leave behind people who behave as we would, think and feel as we would, but who won't remember la Ventura, or Dr. Chatvieux, or Joan Heathor the Earth."

The pilot said nothing more. There was a gray taste in his mouth.

"Saltonstall, what would you recommend as a form?"

The pantropist pulled reflectively at his nose. "Webbed extremities, of course, with thumbs and big toes heavy and thorn-like for defense until the creature has had a chance to learn. Smaller external ears, and the eardrum larger and closer to the outer end of the ear-canal. We're going to have to reorganize the water-conservation system, I think; the glomerular kidney is perfectly suitable for living in fresh water, but the business of living immersed, inside and out, for a creature with a salty inside means that the osmotic pressure inside is going to be higher than outside, so that the kidneys are going to have to be pumping virtually all the time. Under the circumstances we'd best step up production of urine, and that means the antidiuretic function of the pituitary gland is going to have to be abrogated, for all practical purposes."

"What about respiration?"

"Hm," Saltonstall said. "I suppose book-lungs, like some of the arachnids have. They can be supplied by intercostal spiracles. They're gradually adaptable to atmosphere-breathing, if our colonist ever decides to come out of the water. Just to provide for that possibility. I'd suggest that the nose be re-tamed, maintaining the nasal cavity as a part of the otological system, but cutting off the cavity from the larynx with a membrane of cells that are supplied with oxygen by direct irrigation, rather than by the circulatory system. Such a membrane wouldn't survive for many generations, once the creature took to living out of the water even for part of its lifetime; it'd go through two or three generations as an amphibian, and then one day it'd suddenly find itself breathing through its larynx again."

"Ingenious," Chatvieux said.

"Also, Dr. Chatvieux, I'd suggest that we have it adopt spOTulation. As an aquatic animal, our colonist is going to have an indefinite life-span, but we'll have to give it a breeding cycle of about six weeks to keep up its numbers during the learning period; so there'll have to be a definite oreak of some duration in its active year. Otherwise it'll hit the population problem before it's learned enough to cope with it."

"And it'd be better if our colonists could winter over inside a good, hard shell," Eunice Wagner added in agreement. "So sporulation's the obvious answer. Many other microscopic creatures have it."

"Microscopic?" Phil said incredulously.

"Certainly," Chatvieux said, amused. "We can't very well crowd a six-foot man into a two-foot puddle. But that raises a question. We'll have tough competition from the rotifers, and some of them aren't strictly microscopic; for that matter even some of the protozoa can be seen with the naked eye, just barely, with dark-field illumination. I don't think your

average colonist should run much under 250 microns, Saltonstall. Give them a chance to slug it out."

"I was thinking of making them twice that big."

"Then they'd be the biggest animals in their environment," Eunice Wagner pointed out, "and won't ever develop any skills. Besides, if you make them about rotifer size, it will give them an incentive for pushing out the castle-building rotifers, and occupying the castles themselves, as dwellings."

Chatvieux nodded. "All right, let's get started. While the pantropes are being calibrated, the rest of us can put our heads together on leaving a record for these people. We'll micro-engrave the record on a set of corrosion-proof metal leaves, of a size our colonists can handle conveniently. We can tell them, very simply, what happened, and plant a few suggestions that there's more to the universe than what they find in their puddles. Some day they may puzzle it out."

"Question," Eunice Wagner said. "Are we going to tell them they're microscopic? I'm opposed to it. It may saddle their entire early history with a gods-and-demons mythology that they'd be better off without."

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"Yes, we are," Chatvieux said; and la Ventura could tell by the change in the tone of his voice that he was speaking now as their senior on the expedition. "These people will be of the race of men, Eunice. We want them to win their way back into the community of men. They are not toys, to be protected from the truth forever in a fresh-water womb."

"Besides," Saltonstall observed, "they won't get the record translated at any time in their early history. They'll have to develop a written language of their own, and it will be impossible for us to leave them any sort of Rosetta Stone or other key. By the time they can decipher the truth, they should be ready for it."

"I'll make that official," Venezuelos said unexpectedly. And that was that.

And then, essentially, it was all over. They contributed the cells that the pantropes would need. Privately, la Ventura and Joan Heath went to Chatvieux and asked to contribute jointly; but the scientist said that the microscopic men were to be haploid, in order to give them a minute cellular structure, with nuclei as small as Earthly rickettsiae, and therefore each person had to give germ-cells individually; there would be no use for zygotes. So even that consolation was denied them; in death they would have no children, but be instead as alone as ever.

They helped, as far as they could, with the text of the message which was to go on the metal leaves. They had their personality patterns recorded. They went through the motions. Already they were beginning to be hungry; the sea-crayfish, the only things on Hydrot big enough to eat, lived in water too deep and cold for subsistence fishing.

After la Ventura had set his control board to rights a useless gesture, but a habit he had been taught to respect, and which in an obscure way made things a little easier to bear he was out of it. He sat by himself at the far end of the rock ledge, watching Tau Ceti go redly down, chucking pebbles into the nearest pond.

After a while Joan Heath came silently up behind him, and sat down too. He took her hand. The glare of the red sun was almost extinguished now, and together they watched it

go, with la Ventura, at least, wondering somberly which nameless puddle was to be his Lethe. He never found out, of course. None of them did.

Cycle One

In a forgotten corner of the galaxy, the watery world of Hydrot hurtles endlessly around the red star, Tau Ceti. For many months its single small continent has been snowbound, and the many pools and lakes which dot the continent have been locked in the grip of the ice. Now, however, the red sun swings closer and closer to the zenith in Hydrot's sky; the snow rushes in torrents toward the eternal ocean, and the ice recedes toward the shores of the lakes and ponds . . .

The first thing to reach the consciousness of the sleeping Lavon was a small, Intermittent scratching sound. This was followed by a disquieting sensation in his body, as if the world and Lavon with it were being rocked back and forth. He stirred uneasily, without opening his eyes. His vastly slowed metabolism made him feel inert and queasy, and the rocking did not help. At his slight motion, however, both the sound and the motion became more insistent.

It seemed to take days for the fog over his brain to clear, but whatever was causing the disturbance would not let him rest. With a groan he forced his eyelids open and made an abrupt gesture with one webbed hand. By the waves of phosphorescence which echoed away from his fingers at the motion, he could see that the smooth amber walls of his spherical shell were unbroken. He tried to peer through them, but he could see nothing but darkness outside. Well, that was natural; the amniotic fluid inside the spore would generate light, but ordinary water did not, no matter how vigorously it was stirred.

Whatever was outside the sphere was rocking it again, with the same whispering friction against its shell. Probably some nosey diatom, Lavon thought sleepily, trying to butt its way through an object it was too stupid to go around. Or some early hunter, yearning for a taste of the morsel inside the spore. Well, let it worry itself; Lavon had no intention of breaking the shell just yet. The fluid in which he had slept for so many months had held his body processes static, and had slowed his mind. Once out into the water, he would have to start breathing and looking for food again, and he could tell by the unrelieved darkness outside that it was too early in the spring to begin thinking about that.

He flexed his fingers reflectively, in the disharmonic motion from little finger to thumb that no animal but man can copy, and watched the widening wavefronts of greenish light rebound in larger arcs from the curved spore walls. Here he was, curled up quite comfortably in a little amber ball, where he could stay until even the depths were warm and light. At this moment there was probably still some ice on the sky, and certainly there would not be much to eat as yet. Not that there was ever much, what with the voracious rotifers coming awake too with the first gust of warm water.

The rotifers! That was it. "There was a plan afoot to drive them out. Memory returned in an unwelcome rush. As if to help it, the spore rocked again. That was probably one of the Protos, trying to awaken him; nothing man-eating ever came to the Bottom this early. He had left an early call with the Paras, and now the time had come, as cold and early and

dark as he had thought he wanted it.

Reluctantly, Lavon uncurled, planting his webbed toes and arching his backbone as hard as he could, pressing with his whole body against his amber prison. With small, sharp, crepitating sounds, a network of cracks raced through the translucent shell.

Then the spore wall dissolved into a thousand brittle shards, and he was shivering violently with the onslaught of the icy water. The warmer fluid of his winter cell dissipated silently, a faint glowing fog. In the brief light he saw, not far from him, a familiar shape: a transparent, bubble-filled cylinder, a colorless slipper of jelly, spirally grooved, almost as long as he was tall. Its surface was furred with gently vibrating fine hairs, thickened at the base.

The light went out. The Proto said nothing; it waited while Lavon choked and coughed, expelling the last remnants of the spore fluid from his book-lungs and sucking in the pure, ice-cold water.

"Para?" Lavon said at last. "Already?"

"Already," the invisible cilia vibrated in even, emotionless tones. Each separate hair-like process buzzed at an independent, changing rate; the resulting sound waves spread through the water, intermodulating, reinforcing or cancelling each other. The aggregate wave-front, by the time it reached human ears, was rather eerie, but nevertheless recognizable human speech. "This is the time, Lavon."

"Time and more than time," another voice said from the returned darkness. "If we are to drive Flosc from his castles."

"Who's that?" Lavon said, turning futilely toward the new voice.

"I am Para also, Lavon. We are sixteen since the awatening. If you could reproduce as rapidly as we"

"Brains are better than numbers," Lavon said. "As the Eaters will find out soon enough."

"What shall we do, Lavon?"

The man drew up his knees and sank to the cold mud of the bottom to think. Something wriggled under his buttocks and a tiny spirillum corkscrewed away, identifiable only by feel. He let it go; he was not hungry yet, and he had the Eaters to think about. Before long they would be swarming in the upper reaches of the sky, devouring everything, even men when they could catch them, even their natural enemies the Protos now and then. And whether or not the Protos could be organized to battle them was a question still to be tested.

Brains are better than numbers; even that, as a proposition, was still to be tested. "The Protos, after all, were intelligent after their fashion; and they knew their world, as the men did not. Lavon could still remember how hard it had been for him to get straight in his head the various clans of beings in this world, and to make sense of their confused names; his tutor Shar had drilled him unmercifully until it had begun to penetrate.

When you said "Man," you meant creatures that, generally speaking, looked alike. The bacteria were of three kinds, the rods and the globes and the spirals, but they were all tiny and edible, so he had learned to differentiate them quickly. When it came to the Protos, identification became a real problem. Para here was a Proto, but he certainly looked very different from Stent and his family, and the family of Didin

was unlike both. Anything, as it turned out, that was not green and had a visible nucleus was a Proto, no matter how strange its shape might be. The Eaters were all different, too, and some of them were as beautiful as the fruiting crowns of water-plants; but all of them were deadly, and all had the whirling crown of cilia which could suck you into the incessantly grinding mastex in a moment. Everything which was green and had an engraved shell of glass, Shar had called a diatom, dredging the strange word as he dredged them all from some Bottom in his skull which none of the rest of them could reach, and even Shar could not explain.

Lavon arose quickly. "We need Shar," he said. "Where is his spore?"

"On a plant frond, far up near the sky."

Idiot! The old man would never think of safety. To sleep near the sky, where he might be snatched up and borne off by any Eater to chance by when he emerged, sluggish with winter's long sleep! How could a wise man be so foolish?

"We'll have to hurry. Show me the way."

"Soon; wait," one of the Paras said. "You cannot see. Noc is foraging nearby." There was a small stir in the texture of the 'darkness as the swift cylinder shot away.

"Why do we need Shar?" the other Para said.

"For his brains, Para. He is a thinker."

"But his thoughts are water. Since he taught the Protos man's language, he has forgotten to think of the Eaters. He thinks forever of the mystery of how man came here. It is a mystery even the Eaters are not like maa. But understanding it will not help us to live."

Lavon turned blindly toward the creature. "Para, tell me something. Why do the Protos side with us? With man, I mean? Why do you need us? The Eaters fear you."

There was a short silence. When the Para spoke again, the vibrations of its voice were more blurred than before, more even, more devoid of any understandable feeling.

"We live in this world," the Para said. "We are of it. We rule it. We came to that state long before the coming of men, in long warfare with the Eaters. But we think as the Eaters do, we do not plan, we share our knowledge and we exist. Men plan; men lead; men are different from each other; men want to remake the world. And they hate the Eaters, as we do. We will help."

"And give up your rule?"

"And give it up, if the rule of men is better. That is reason. Now we can go; Noc is coming back with light."

Lavon looked up. Sure enough, there was a brief flash of cold light far overhead, and then another. In a moment the spherical Proto had dropped into view, its body flaring regularly with blue-green pulses. Beside it darted the second Para.

"Noc brings news," the second Para said. "Para is twenty-four. The Syn are awake by thousands along the sky. Noc spoke to a Syn colony, but they will not help us; they all expect to be dead before the Eaters awake."

"Of course," said the first Para. "That always happens. And the Syn are plants; why should they help the Protos?"

"Ask Noc if he'll guide us to Shar," Lavon said impatiently.

The Noc gestured with its single short, thick tentacle. One of the Paras said, "That is what he is here for."

"Then let's go. We've waited long enough."

The mixed quartet soared away from the Bottom' through the liquid darkness.

"No," Lavon snapped. "Not a second longer. The Syn are awake, and Nothoica of the Eaters is due right after that. You know that as well as I do, Shar. Wake up!"

"Yes, yes," the old man said fretfully. He stretched and yawned. "You're always in such a hurry, Lavon. Where's Phil? He made his spore near mine." He pointed to a still-unbroken amber sphere sealed to a leaf of the water-plant one tier below. "Better push him off; he'll be safer on the Bottom."

"He would never reach the Bottom," Para said. "The thermocline has formed."

Shar looked surprised. "It has? Is it as late as all that? Wait while I get my records together." He began to search along the leaf in the debris and the piled shards of his spore. Lavon looked impatiently about, found a splinter of stonewort, and threw it heavy end first at the bubble of Phil's cell just below. The spore shattered promptly, and the husky young man tumbled out, blue with shock as the cold water hit him.

"Woughl" he said. "Take it easy, Lavon." He looked up. "The old man's awake? Good. He insisted on staying up here for the winter, so of course I had to stay too."

"Aha," Shar said, and lifted a thick metal plate about the length of his forearm and half as wide. "Here is one of them. Now if only I haven't misplaced the other"

Phil kicked away a mass of bacteria. "Here it is. Better give them both to a Para, so they won't burden you. Where do we go from here, Lavon? It's dangerous up this high. I'm just glad a Dicran hasn't already shown up."

"I here," something droned just above them.

Instantly, without looking up, Lavon flung himself out and down into the open water, turning his head to look back over his shoulder only when he was already diving as fast as he could go. Shar and Phil had evidently sprung at the same instant. On the next frond above where Shar had spent his winter was the armored, trumpet-shaped body of the rotifer Dicran, contracted to leap after them.

The two Protos came curving back out of nowhere. At the same moment, the bent, shortened body of Dicran flexed in its armor plate, straightened, came plunging toward them. There was a soft *plop* and Lavon found himself struggling in a fine net, as tangled and impassible as the mat of a lichen. A second such sound was followed by a muttered imprecation from Phil. Lavon struck out fiercely, but he was barely able to wriggle in the web of wiry, transparent stuff.

"Be still," a voice which he recognized as Para's throbbed behind him. He managed to screw his head around, and then kicked himself mentally for not having realized at once what had happened. The Paras had exploded the trichocysts which lay like tiny cartridges beneath their pellicles; each one cast forth a liquid which solidified upon contact with the water in a long slender thread. It was their standard method of defense.

Farther down, Shar and Phil drifted with the second Para in the heart of a white haze, like creatures far gone in mold. Dicran swerved to avoid it, but she was evidently unable to give up; she twisted and darted around them, her corona buzzing harshly, her few scraps of the human language forgotten. Seen from this distance, the rotation of the corona was revealed as an illusion, created by the rhythm of pulsa-

tion of the individual cilia, but as far as Lavon was concerned the point was solely technical and the distance was far too short. Through the transparent armor Lavon could also see the great jaws of Dicran's mastax, grinding away mechanically at the fragments which poured into her unheeding mouth.

High above them all, Noc circled indecisively, illuminating the whole group with quick, nervous flashes of his blue light. He was a flagellate, and had no natural weapons against the rotifer; why he was, hanging around drawing attention to himself Lavon could not imagine.

Then, suddenly, he saw the reason: a barrel-like creature about Noc's size, ringed with two rows of cilia and bearing a ram-like prow. "Didin!" he shouted, unnecessarily. "This way!"

The Proto swung gracefully toward them and seemed to survey them, though it was hard to tell how he could see them without eyes. The Dicran saw him at the same time and began to back slowly away, her buzzing rising to a raw snarl. She regained the plant and crouched down.

For an instant Lavon thought she was going to give up, but experience should have told him that she lacked the sense. Suddenly the lithe, crouched body was in full spring again, this time straight at Didin. Lavon yelled an incoherent warning.

The Proto didn't need it. The slowly cruising barrel darted to one side and then forward, with astonishing speed. If he could sink that poisoned seizing-organ into a weak point in the rotifer's armor

Noc mounted higher to keep out of the way of the two fighters, and in the resulting weakened light Lavon could not see what was happening, though the furious chumirig of the water and the buzzing of the Dicran continued.

After a while the sounds seemed to be retreating; Lavon crouched in the gloom inside the Para's net, listening intently. Finally there was silence.

"What's happened?" he whispered tensely.

"Didin does not say."

More eternities went by. Then the darkness began to wane as Noc dropped cautiously toward them.

"Noc, where did they go?"

Noc signaled with his tentacle and turned on his axis toward Para. "He says he lost sight of them. Wait! hear Didin."

Lavon could hear nothing; what the Para "heard" was some one of these semi-telepathic impulses which made up the Proto's own language.

"He says Dioran is dead."

"Good! Ask him to bring the body back here."

There was a short silence. "He says he will bring it. What good is a dead rotifer, Lavon?"

"You'll see," Lavon said. He watched anxiously until Didin glided backwards into the lighted area, his poisonous ram sunk deep into the flaccid body of the rotifer, which, after the delicately-organized fashion of its kind, was already beginning to disintegrate.

"Let me out of this net, Para."

The Proto jerked sharply for a fraction of a turn on its long axis, snapping the threads off at the base; the movement had to be made with great precision, or its pellicle would tear

as well. The tangled mass rose gently with the current and drifted off over the abyss.

Lavon swam forward and, seizing one buckled edge of Dicran's armor, tore away a huge strip of it. His hands plunged into the now almost shapeless body and came out again holding two dark spheroids: eggs.

"Destroy these, Didin," he ordered. The Proto obligingly slashed them open.

"Hereafter," Lavon said, "that's to be standard procedure with every Eater you kill."

"Not the males," one of the Para pointed out.

"Para, you have no sense of humor. All right, not the males but nobody kills the males anyhow, they're harmless." He looked down grimly at the inert mass. "Rememberdestroy the eggs. Killing the beasts isn't enough. We want to wipe out the whole race."

"We never forget," Para said emotionlessly.

The band of over two hundred humans, with Lavon and Shar and a Para at its head, fled swiftly through the warm, light waters of the upper level. Each man gripped a wood splinter, or a fragment of lime chipped from stonewort, as a club; and two hundred pairs of eyes darted watchfully from side to side. Cruising over them was a squadron of twenty Didins, and the rotifers they encountered only glared at them from single red eyespots, making no move to attack. Overhead, near the sky, the sunlight was filtered through a thick layer of living creatures, fighting and feeding and spawning, so that all the depths below were colored a rich green. Most of this heavily populated layer was made up of algae and diatoms, and there the Eaters fed unhindered. Sometimes a dying diatom dropped slowly past the army.

The spring was well advanced; the two hundred, Lavon thought, probably represented all of the humans who had survived the winter. At least no more could be found. The othersnobody would ever know how manyhad awakened too late in the season, or had made their spores in exposed places, and the rotifers had snatched them up. Of the group, more than a third were women. That meant that in another forty days, if they were unmolested, they could double the size of their army.

If they were unmolested. Lavon grilmed and pushed an agitated colony of Eudorina out of his way. The phrase reminded him of a speculation Shar had brought forth last year: If Para were left unmolested, the oldster had said, he could reproduce fast enough to fill this whole universe with a solid mass of Paras before the season was out. Nobody, of course, ever went unmolested in this world; nevertheless, Lavon meant to cut the odds for people considerably below anything that had heretofore been thought of as natural.

His hand flashed up, and down again. The darting squadrons plunged after him. "The light on the sky faded rapidly, and after a while Lavon began to feel slightly chilly. He signaled again. Like dancers, the two hundred swung their bodies in mid-flight, plunging now feet first toward the Bottom. To strike the thermocline in this position would make their passage through it faster, getting them out of the upper level where every minute, despite the convoy of Protos, concentrated danger.

im

Lavon's feet struck a yielding surface, and with a splash he

was over his head in icy water. He bobbed up again, feeling the icy division drawn across his shoulders. Other splashes began to sound all along the thermocline as the army struck it, although, since there was water above and below, Lavon could not see the actual impacts.

Now they would have to wait until their body temperatures fell. At this dividing line of the universe, the warm water ended and the temperature dropped rapidly, so that the water below was much denser and buoyed them up. The lower level of cold reached clear down to the Bottoman area which the rotifers, who were not very clever, seldom managed to enter.

A moribund diatom drifted down beside Lavon, the greenish-yellow of its body fading to a sick orange, its beautifully-marked, oblong, pillbox-like shell swarming with greedy bacteria. It came to rest on the thermocline, and the transparent caterpillar tread of jelly which ran around it moved feebly, trying vainly to get traction on the sliding water interface. Lavon reached out a webbed hand and brushed away a clot of vibrating rods which had nearly forced its way into the shell through a costal opening.

"Thank . . ." the diatom said, in an indistinct, whispering voice. And again, "Thank . . . Die . . ." The gurgling whisper faded. The caterpillar tread shifted again, then was motionless.

"It is right," a Para said. "Why do you bother with those creatures? They are stupid. Nothing can be done for them."

Lavon did not try to explain. He felt himself sinking slowly, and the water about his trunk and legs no longer seemed cold, only gratefully cool after the stifling heat of that he was breathing. In a moment the cool still depths had closed over his head. He hovered until he was reasonably sure that all the rest of his army was safely through, and the long ordeal of search for survivors in the upper level really ended. Then he twisted and streaked for the Bottom, Phil and Para beside him, Shar puffing along with the vanguard.

A stone loomed; Lavon surveyed it in the half-light. Almost immediately he saw what he had hoped to see: the sand-built house of a caddis-worm, clinging to the mountainous slopes of the rock. He waved in his special cadre and pointed.

Cautiously the men spread out in a U around the stone, the mouth of the U facing the same way as the opening of the worm's masonry tube. A Noc came after them, drifting like a star-shell above the peak; one of the Paras approached the door of the worm's house, buzzing defiantly. Under cover of this challenge the men at the back of the U settled on the rock and began to creep forward. The house was three times as tall as they were; the slimy black sand grains of which it was composed were as big as their heads.

There was a stir inside, and after a moment the ugly head of the worm peered out, weaving uncertainly at the buzzing Para which had disturbed it. The Para drew back, and the worm, in a kind of blind hunger, followed it. A sudden lunge brought it nearly halfway out of its tube.

Lavon shouted. Instantly the worm was surrounded by a howling horde of two-legged demons, who beat *and* prodded it mercilessly with fists and clubs. Somehow it made a sound, a kind of bleat as unlikely as the bird-like whistle of a fish, and began to slide backwards into its home but the rear

guard had already broken in back there. It jerked forward again, lashing from side to side under the flogging.

There was only one way now for the great larva to go, and the demons around it kept it going that way. It fell toward the Bottom down the side of the rock, naked and ungainly, shaking its blind head and bloating.

Lavon sent five Didin after it. They could not kill it, for it was far too huge to die under their poison, but they could sting it hard enough to keep it travelling. Otherwise, it would be almost sure to return to the rock to start a new house.

Lavon settled on an abutment and surveyed his prize with satisfaction. It was more than big enough to hold his entire clana great tubular hall, easily defended once the breach in the rear wall was rebuilt, and well out of the usual haunts of the Eaters. The muck the caddis-worm had left behind would have to be cleaned up, guards posted, vents knocked out to keep the oxygen-poor water of the depths in motion inside. It was too bad that the amoebae could not be detailed to scavenge the place, but Lavon knew better than to issue such an order. The Fathers of the Protos could not be asked to do useful work; that had been made very clear.

He looked around at his army. They were standing around him in awed silence, looking at the spoils of their attack upon the largest creature in the world. He did not think they would ever again feel as timid toward the Eaters. He stood up quickly.

"What are you gaping at?" he shouted. "It's yours, all of it. Get to work!"

Old Shar sat comfortably upon a pebble which had been holoUowed out and cushioned with spirogyra straw. Lavon stood nearby at the door, looking out at the maneuvers of his legions. They numbered more than three hundred now, thanks to the month of comparative quiet which they had enjoyed in the great hall, and they handled their numbers well in the aquatic drill which Lavon had invented for them. "They swooped and turned above the rock, breaking and re-assembling their formations, fighting a sham battle with invisible opponents whose shape they could remember only too well.

"Noc says there's all kinds of quarreling going on among the Eaters," Shar said. "They didn't believe we'd joined with the Protos at first, and then they didn't believe we'd all worked together to capture the hall. And the mass raid we had last week scared them. They'd never tried anything of the kind before, and they *knew* it wouldn't fail. Now they're fighting with each other over why it did. Cooperation is something new to this world, Lavon; it's making history."

"History?" Lavon said, following his drilling squadrons with a technical eye. "What's that?"

"These." The old man leaned over one arm of the pebble and touched the metal plates which were always with him. Lavon turned to follow the gesture, incuriously. He knew the plates well enough the pure uncorroded shining, graven deeply on both sides with characters no-one, not even Shar, could read. The Protos called the plates *Not-staff* neither wood nor flesh nor stone.

"What good is that? I can't read it. Neither can you."

"I've got a start, Lavon. I know the plates are written in our language. Look at the first word: *ha ii ss tub oh or ee* exactly the right number of characters for 'history'. That

can't be a coincidence. And the next two words have to be 'of the'. And going on from there, using just the Characters I already know" Shar bent and traced in the sand with a stick a new train of characters: *illerstel / or el / elition*.

"What's that?"

"It's a start, Lavon. Just a start. Some day we'll have more."

Lavon shrugged. "Perhaps, when we're safer. We can't afford to worry about that kind of thing now. We've never had that kind of time, not since the First Awakening."

The old man frowned down at the characters in the sand. "The First Awakening. Why does everything seem to stop there? I can remember in the smallest detail nearly everything that happened to me since then. But what happened to our childhoods, Lavon? None of us who survived the First Awakening seems to have had one. Who were our parents? Why were we so ignorant of the world, and yet grown men and women, all of us?"

"And the answer is in the plates?"

"I hope so," Shar said. "I believe it is. But I don't know. The plates were beside me in the spore at the First Awakening. That's all I know about them, except that there's nothing else like them in the world. The rest is deduction, and I haven't gotten very far with it. Some day . . . some day."

"I hope so too," Lavon said soberly. "I don't mean to mock, Shar, or to be impatient. I've got questions, too; we all have. But we're going to have to put them off for a while. Suppose we never find the whole answer?"

"Then our children will."

"But there's the heart of the problem, Shar: we have to live to have children. And make the kind of a world in which they'll have time to study. Otherwise"

Lavon broke off as a figure darted between the guards at the door of the hall and twisted to a halt

"What news, Ihil?"

"The same," Phil said, shrugging with his whole body. His feet touched the floor. "The Flosc's castles are going up all along the bar; they'll be finished with them soon, and then we won't dare to get near them. Do you still *Mnic* you can drive them out?"

Lavon nodded.

"But why?"

"First, for effect. We've been on the defensive so far, even though we've made a good job of it. We'll have to follow that up with an attack of our own if we're going to keep the Eaters confused. Second, the castles Flosc builds are all tunnels and exits and entrances much better than worm-houses for us. I hate to think of what would have happened if the Eaters had thought of blockading us inside this hall. And we need an outpost in enemy country, Phil, where there are Eaters to kill."

"This is enemy country," Phil said. "Stephanost is a Bottom-dweller."

"But she's only a trapper, not a hunter. Any time we want to kill her, we can find her right where we left her last. It's the leapers like Dicran and Nothoica, the swimmers like Rotar, the colony-builders like Flosc that we have to wipe out first."

"Then we'd better start now, Lavon. Once the castles are finished"

"Yes. Get your squads together, Phil. Shar, come on; we're leaving the hall."

"To raid the castles?"

"Of course."

Shar picked up his plates.

"You'd better leave those here; they'll be in your way in the fighting."

"No," Shar said determinedly. "I don't want them out of my sight. They go along."

Vague forebodings, all the more disturbing because he had felt nothing quite like them ever before, passed like clouds of fine silt through Lavon's mind as the army swept away from the hall on the Bottom and climbed toward the thermocline. As far as he could see, everything seemed to be going as he had planned it. As the army moved, its numbers were swelled by Protos who darted into its ranks from all sides. Discipline was good; and every man was armed with a long, seasoned splinter, and from each belt swung a stonewort-flake hand-axe, held by a thong run through a hole Shar had taught them all how to drill. There would probably be much death before the light of today faded, but death was common enough on any day, and this time it should heavily disfavor the Eaters.

But there was a chill upon the depths that Lavon did not like, and a suggestion of a current in the water which was unnatural below the thermocline. A great many days had been consumed in collecting the army, recruiting from stragglers, and in securing the hall. The intensive breeding which had followed, and the training of the new-born and the newly recruited, had taken still more time, all of it essential, but all irrevocable. If the chill and the current marked the beginning of the fall turnover . . .

If it did, nothing could be done about it. The turnover could no more be postponed than the coming of day or night. He signaled to the nearest Para.

The glistening torpedo veered toward him. Lavon pointed up.

"Here comes the thermocline, Para. Are we pointed right?"

"Yes, Lavon. That way is the place where the Bottom rises toward the sky. Flosc's castles are on the other side, where she will not see us."

"The sand bar that runs out from the north. Right. It's getting warmer. Here we go."

Lavon felt his flight suddenly quicken, as if he had been shot like a seed from some invisible thumb and forefinger. He looked over his shoulder to watch the passage of the rest through the temperature barrier, and what he saw thrilled him as sharply as any awakening. Up to now he had had no clear picture of the size of his forces, or the three-dimensional beauty of their dynamic, mobile organization. Even the Protos had fitted themselves into the squads; pattern after pattern of power came soaring after Lavon from the Bottom: first a single Noc bowling along like a beacon to guide all the rest, then an advance cone of Didin to watch for individual Eaters who might flee to give the alarm, and then the men, and the Protos, who made up the main force, in tight formations as beautiful as the elementary geometry from which Shar had helped derive them.

The sand-bar loomed ahead, as vast as any mountain range.

Lavon soared sharply upward, and he tumbled, raw-boned boulders of the sand grains swept by rapidly beneath him in a broad, stony flood. Far beyond the ridge, towering up to the sky through glowing green obscurity, were the befronned stems of the plant jungle which was their objective. It was too dim with distance to allow him to see the clinging castles of the Flosc yet, but he knew that the longest part of the march was over. He narrowed his eyes and cleft the sunlit waters with driving, rapid strokes of his webbed hands and feet. The invaders poured after him over the crest of the bar in an orderly torrent.

Lavon swung his arm in a circle. Silently, the following squadrons glided into a great paraboloid, its axis pointed at the jungle. The castles were visible now; until the formation of the army, they had been the only products of close co-operation that this world had ever seen. They were built of single brown tubes, narrow at the base, attached to each other in a random pattern in an ensemble as delicate as a branching coral. In the mouth of each tube was a rotifer, a Flosc, distinguished from other Eaters by the four-leaf-clover of its corona, and by the single, prehensile finger springing from the small of its back, with which it ceaselessly molded its brown spittle into hard pellets and cemented them carefully to the rim of its tube.

As usual, the castles chilled Lavon's muscles with doubt. They were perfect, and they had always been one of the major, stony flowers of summer, long before there had been any First Awakening, or any men. And there was surely something wrong with the water in the upper level; it was warm and sleepy. The heads of the Flosc hummed contentedly at the mouths of their tubes; everything was as it should be, as it had always been; the army was a fantasm, the attack a failure before it had begun.

Then they were spied.

The Flosc vanished instantly, contracting violently into their tubes. The placid humming of their continuous feeding upon everything that passed was snuffed out; spared motes drifted about the castle in the light.

Lavon found himself smiling. Not long ago, the Flosc would only have waited until the humans were close enough, and then would have sucked them down, without more than a few struggles here and there, a few pauses in the humming while the out-size morsels were enfolded and fed into the grinders. Now, instead, they hid; they were afraid.

"Go!" he shouted at the top of his voice. "Kill them! Kill them while they're down!"

The army behind him swept after him with a stunning composite shout.

Tactics vanished. A petalled corona unfolded in Lavon's face, and a buzzing whirlpool spun him toward its black heart. He slashed wildly with his edged wooden splinter.

The sharp edge sliced deeply into the ciliated lobes. The rotifer screamed like a siren and contracted into her tube, closing her wounded face. Grimly, Lavon followed.

It was pitch dark inside the castle, and the raging currents of pain which flowed past him threw him from one pebbly wall to another. He gritted his teeth and probed with the splinter. It bit into a yielding surface at once, and another scream made his ears ring, mixed with mangled bits of words in Lavon's own language, senseless and horrible with agony.

He slashed at them until they stopped, and continued to slash until he could control his terror.

As soon as he was able, he groped in the torn corpse for the eggs. The point found their life and pricked it. Trembling, he pulled himself back to the mouth of the tube, and without stopping to think pushed himself off at the first Eater to pass it.

The thing was a Dicran; she doubled viciously upon him at once. Even the Eaters had learned something about cooperation. And the Dicrans fought well in open water. They were the best possible reinforcements the Flosc could have called.

The Dicran's armor turned the point of Lavon's splinter easily. He jabbed frantically, hoping to hit a joint, but the agile creature gave him no time to aim. She charged him irresistibly, and her humming corona folded down around his head, pinned his forearms to his sides

The Eater heaved convulsively and went limp. Lavon half slashed, half tore his way free. A Didin was drawing back, pulling out its seizing-organ. The body floated downward.

"Thanks," Lavon gasped. The Proto darted off without replying; it lacked sufficient cilia to imitate human speech. Possibly it lacked the desire as well; the Didins were not sociable.

A tearing whirlpool sprang into being again around him, and he flexed his sword-arm. In the next five dreamlike minutes he developed a technique for dealing with the sessile, sucking Flosc. Instead of fighting the current and swinging the splinter back and forth against it, he gave in to the vortex, rode with it, and braced the splinter between his feet, point down. The results were even better than he had hoped. The point, driven by the full force of the Flosc's own trap, pierced the soft, wormlike body half through while it gaped for the human quarry. After each encounter, Lavon doggedly went through the messy ritual of destroying the eggs.

At last he emerged from a tube to find that the battle had drifted away from him. He paused on the edge to get his breath back, clinging to the rounded, translucent bricks and watching the fighting. It was difficult to make any military sense out of the melee, but as far as he could tell the rotifers were getting the worst of it. They did not know how to meet so carefully organized an attack, and they were not in any real sense intelligent.

The Didin were ranging from one side of the fray to the other, in two tight, vicious efficient groups, englobing and destroying free-swimming rotifers in whole flocks at a time. Lavon saw no fewer than half a dozen Eaters trapped by teams of Paras, each pair dragging a struggling victim in a trichocyst net remorselessly toward the Bottom, where she would inevitably suffocate. He was astonished to see one of the few Noes that had accompanied his army scouring a cringing Rotar with its virtually harmless tentacle; the Eater seemed too astonished to fight back, and Lavon for once knew just how she felt.

A figure swam slowly and tiredly up to him from below. It was old Shar, puffing hard. Lavon reached a hand down to him and hauled him onto the lip of the tube. The man's face wore a frightening expression, half shock, half pure grief.

"Gone, Lavon," he said. "Gone. Lost."
"What? What's gone? What's the matter?"

"The plate. You were right. I should have known." He sobbed convulsively.

"What plate? Calm down. What happened? Did you lose one of the history plates or both of them?"

Slowly his tutor seemed to be recovering control of his breathing. "One of them," he said wretchedly. "I dropped it in the fight. I hid the other one in an empty Flosc tube. But I dropped the first one the one I'd just begun to decipher. It went all the way down to the Bottom, and I couldn't get free to go after it all I could do was watch it go, spinning down into the darkness. We could sift the mud forever and never find it."

He dropped his face into his hands. Perched on the edge of the brown tube in the green glow of the waters, he looked both pathetic and absurd. Lavon did not know what to say; even he realized that the loss was major and perhaps final, that the awesome blank in their memories prior to the First Awakening might now never be filled. How Shar felt about it he could comprehend only dimly.

Another human figure darted and twisted toward him. "Lavon!" Phil's voice cried. "It's working, it's working! The swimmers are running away, what's left of them. There are still some Flosc in the castles, hiding in the darkness. If we could only lure them out in the open"

Jarred back to the present, Lavon's mind raced over the possibilities. The whole attack could still fail if the Flosc entrenched themselves successfully. After all, a big kill had not been the only object; they had started out to capture the castles.

"Shardo these tubes connect with each other?"

"Yes," the old man said without interest. "It's a continuous system."

Lavon sprang out upon the open water. "Come on, Phil. We'll attack them from the rear." Turning, he plunged into the mouth of the tube, Phil on his heels.

It was very dark, and the water was fetid with the odor of the tube's late owner, but after a moment's groping Lavon found the opening which lead into the next tube. It was easy to tell which way was out because of the pitch of the walls; everything the Flosc built had a conical bore, differing from the next tube only in size. Determinedly Lavon worked his way toward the main stem, going always down and in.

Once they passed beneath an opening beyond which the water was in furious motion, and out of which poured muffled sounds of shouting and a defiant buzz. Lavon stopped to probe through the hole with his sword. The rotifer gave a shrill, startled shriek and jerked her wounded tail upward, involuntarily releasing her toe-hold upon the walls of the tube. Lavon moved on, grinning. The men above would do the rest.

Reaching the central stem at last, Lavon and Phil went methodically from one branch to another, spearing the surprised Eaters from behind or cutting them loose so that the men outside could get at them as they drifted upward, propelled by the drag of their own coronas. The trumpet shape of the tube* prevented the Eaters from turning to fight, and from following them through the castle to surprise them from behind; each Plosc had only the one room, which she never left.

The gutting of the castles took hardly fifteen minutes. The

day was just beginning to end when Lavon emerged with Phil at the mouth of a turret to look down upon the first. City of Man.

He lay in darkness, his forehead pressed against his knees, as motionless as a dead man. The water was stuffy, cold, the blackness complete. Around him were the walls of a tube of Flosc's castle; above him a Para laid another sand grain upon a new domed roof. The rest of the army rested in other tubes, covered with other new stony caps, but there was no sound of movement or of voices. It was as quiet as a necropolis.

Lavon's thoughts were slow and bitter as drugged syrup. He had been right about the passage of the seasons. He had had barely enough time to bring all his people from the hall to the castles before the annual debacle of the fall overturn. Then the waters of the universe had revolved once, bringing the skies to the Bottom, and the Bottom to the skies, and then mixing both. The thermocline was destroyed until next year's spring overturn would reform it.

And inevitably, the abrupt change in temperature and oxygen concentration had started the spore-building glands again. The spherical amber shell was going up around Lavon now, and there was nothing he could do about it. It was an involuntary process, as dissociated from his control as the beating of his heart. Soon the light-generating oil which filled the spore would come pouring out, expelling and replacing the cold, foul water, and then sleep would come ...

And all this had happened just as they had made a real gain, had established themselves in enemy country, had come within reach of the chance to destroy the Eaters wholesale and forever. Now the eggs of the Eaters had been laid, and next year it would have to be done all over again. And there was the loss of the plate; he had hardly begun to reflect upon what that would mean for the future.

There was a soft *chunk* as the last sand grain fell into place on the roof. The sound did not quite bring the final wave of despair against which he had been fighting in advance. Instead, it seemed to carry with it a wave of obscure contentment, with which his consciousness began to sink more and more rapidly toward sleep. They were safe, after all. They could not be ousted from the castle. And there would be fewer Eaters next year, because of all the eggs that had been destroyed, and the layers of those eggs . . . There was one plate still left...

Quiet and cold; darkness and silence.

In a forgotten corner of the galaxy, the watery world of Hydrot hurtles endlessly around the red star, Tau Ceti. For many months life has swarmed in its lakes and pools, but now the sun retreats from the zenith, and the snow falls, and the ice advances from the eternal ocean. Life sinks once more toward slumber, simulating death, and the battles and lusts and ambitions and defeats of a thousand million microscopic creatures retreat in to the limbo where such things matter not at all.

No, such things matter not at all when winter reigns on Hydrot; but winter is an inconstant king.

Cycle Two

Old Shar set down the thick, ragged-edged metal plate at last,

and gazed instead out the window of the castle, apparently resting his eyes on the glowing green-gold obscurity of the summer waters. In the soft fluorescence which played down upon him, from the Noc dozing impassively in the groined vault of the chamber, Lavon could see that he was in fact a young man. His face was so delicately formed as to suggest that it had not been many seasons since he had first emerged from his spore.

But of course there had been no real reason to have expected an old man. All the Shars had been referred to traditionally as "old" Shar. The reason, like the reasons for everything else, had been forgotten, but the custom had persisted. The adjective at least gave weight and dignity to the office that of the center of wisdom of all the people, as each Lavon had been the center of authority.

The present Shar belonged to the generation XVI, and hence would have to be at least two seasons younger than Lavon himself. If he was old, it was only in knowledge.

"Lavon, I'm going to have to be honest with you," Shar said at last, still looking out of the tall, irregular window. "You've come to me at your maturity for the secrets on the metal plate, just as your predecessors did to mine. I can give some of them to you but for the most part, I don't know what they mean."

"After so many generations?" Lavon asked, surprised. "Wasn't it Shar III who made the first complete translation? That was a long time ago."

The young man turned and looked at Lavon with eyes made dark and wide by the depths into which they had been staring. "I can read what's on the plate, but most of it seems to make no sense. Worst of all, the record's incomplete. You didn't know that? It is. One of the plates was lost in a battle during the first war with the Eaters, while these castles were still in their hands."

"What am I here for, then?" Lavon said. "Isn't there anything of value on the remaining plate? Did they really contain 'the wisdom of the Creators,' or is that another myth?"

"No. No, it's true," Shar said slowly, "as far as it goes."

He paused, and both men turned and gazed at the ghostly creature which had appeared suddenly outside the window. Then Shar said gravely, "Come in, Para."

The slipper-shaped organism, nearly transparent except for the thousands of black-and-silver granules and frothy bubbles which packed its interior, glided into the chamber and hovered, with a muted whirring of cilia. For a moment it remained silent, speaking telepathically to the Noc floating in the vault, after the ceremonious fashion of all the Protos. No human had ever intercepted one of these colloquies, but there was no doubt about their reality; humans had used them for long-range communication for generations.

Then the Para's cilia vibrated once more. "We are arrived, Shar and Lavon, according to the custom."

"And welcome," said Shar. "Lavon, let's leave this matter of the plates for a while, until you hear what Para has to say; that's a part of the knowledge Lavons must have as they come into their office, and it comes before the plates. I can give you some hints of what we are. First Para has to tell you something about what we aren't."

Lavon nodded, willingly enough, and watched the Proto as it settled gently to the surface of the hewn table at which Shar

had been sitting. There was in the entity such a perfection and economy of organization, such a grace and surety of movement, that he could hardly believe in his own new-won maturity. Para, like all the Protos, made him feel, not perhaps poorly thought-out, but at least unfinished.

"We know that in this universe there is logically no place for man," the gleaming, now immobile cylinder upon the table droned abruptly. "Our memory is the common property of all our races. It reaches back to a time when there were no such creatures as man here, nor any even remotely like men. It remembers also that once upon a day there were men here, suddenly, and in some numbers. Their spores littered the Bottom; we found the spores only a short time after our season's Awakening, and inside them we saw the forms of men, slumbering.

"Then men shattered their spores and emerged. At first they seemed helpless, and the Eaters devoured them by scores, as in those days they devoured everything that moved. But that soon ended. Men were intelligent, active. And they were gifted with a trait, a character, possessed by no other creature in this world. Not even the savage Eaters had it. Men organized us to exterminate the Eaters, and therein lay the difference. Men had initiative. We have the word now, which you gave us, and we apply it, but we still do not know what the thing is that it labels."

"You fought beside us," Lavon said.

"Gladly. We would never have thought of that war by ourselves, but it was good and brought good. Yet we wondered. We saw that men were poor swimmers, poor walkers, poor crawlers, poor climbers. We saw that men were formed to make and use tools, a concept we still do not understand, for so wonderful a gift is largely wasted in this universe, and there is no other. What good are tool-useful members such as the hands of men? We do not know. It seems plain that so radical a thing should lead to a much greater rulership over the world than has, in fact, proven to be possible for men."

Lavon's head was spinning. "Para, I had no notion that you people were philosophers."

"The Protos are old," Shar said. He had again turned to look out the window, his hands locked behind his back. "They aren't philosophers, Lavon, but they are remorseless logicians. Listen to Para."

"To this reasoning there could be but one outcome," the Para said. "Our strange ally, Man, was like nothing else in this universe. He was and is unfitted for it. He does not belong here; he has been adapted. This drives us to think that there are other universes besides this one, but where these universes might lie, and what their properties might be, it is impossible to imagine. We have no imagination, as men know."

Was the creature being ironic? Lavon could not tell. He said slowly. "Other universes? How could that be true?"

"We do not know," the Para's uninflected voice hummed. Lavon waited, but obviously the Proto had nothing more to say.

Shar had resumed sitting on the window sill, clasping his knees, watching the come and go of dim shapes in the lighted gulf. "It is quite true," he said. "What is written on the plate makes it plain. Let me tell you now what it says.

"*We were made*, Lavon. We were made by men who were not as we are, but men who were our ancestors all the same.

They were caught in some disaster, and they made us, and put us here in our universeso that, even though they had to die, the race of men would live."

Lavon surged up from the woven spirogyra mat upon which he had been sitting. "You must think I'm a fool," he said sharply.

"No. You're our Lavon; you have a right to know the facts. Make what you like of them." Shar swung his webbed toes back into the chamber. "What I've told you may be hard to believe, but it seems to be so; what Para says backs it up. Our unfitnes to live here is self-evident. I'll give you some examples:

"The past four Shars discovered that we won't get any farther in our studies until we learn how to control heat. We've produced enough heat chemically to show that even the water around us changes when the temperature gets high enough or low enough, that we knew from the beginning. But there we're stopped."

"Why?"

"Because heat produced in open water is carried off as rapidly as it's produced. Once we tried to enclose that heat, and we blew up a whole tube of the castle and killed everything in range; the shock was terrible. We measured the pressures that were involved in that explosion, and we discovered that no substance we know could have resisted them. Theory suggests some stronger substancesbut *we need heat to form them!*

"Take our chemistry. We live in water. Everything seems to dissolve in water, to some extent. How do we confine a chemical test to the crucible we put it in? How do we maintain a solution at one dilution? I don't know. Every avenue leads me to the same stone door. We're thinking creatures, Lavon, but there's something drastically wrong in the way we think about this universe we live in. It just doesn't seem to lead to results."

Lavon pushed back his floating hair futilely. "Maybe you're thinking about the wrong results. We've had no trouble with warfare, or crops, or practical things like that. If we can't create much heat, well, most of us won't miss it; we don't need more than we "have. What's the other universe supposed to be like, the one our ancestors lived in? Is it any better than this one?"

"I don't know," Shar admitted. "It was so different that it's hard to compare the two. The metal plate tells a story about men who were travelling from one place to another in a container that moved by itself. The only analogue I can think of is 'the shallops of diatom shells that our youngsters used to sled along the thennocline; but evidently what's meant is something much bigger.

"I picture a huge shallop, closed on all sides, big enough to hold many peoplemaybe twenty or thirty. It had to travel for generations through some kind of medium where there wasn't any water to breathe, so the people had to carry their own water and renew it constantly. There were no seasons; no ice formed on the sky, because there couldn't be any sky in a closed shallop; and so there was no spore formation.

"Then the shallop was wrecked somehow. The people in it knew they were going to die. They made us, and put us here, as if we were their children. Because they had to die, they

wrote their story on the plates, to tell us what had happened. I suppose we'd Understand it better if we had the plate Shar I lost during the warbut we don't."

"The whole thing sounds like a parable," Lavon said, shrugging. "Or a song. I can see why you don't understand it. What I can't see is why you bother to try."

"Because of the plate," Shar said. "You've handled it yourself now, so you know that we've nothing like it. We have crude, impure metals we've hammered out, metals that last for a while and then decay. But the plate shines on, generation after generation. It doesn't change; our hammers and our graving tools break against it; the little heat we can generate leaves it unharmed. That plate wasn't formed in our universeand that one fact makes every word on it important to me. Someone went to a great deal of trouble to make those plates indestructible, and to give them to us. Someone to whom the word 'stars' was important enough to be worth fourteen repetitions, despite the fact that the word doesn't seem to mean anything. I'm ready to think that if our makers repeated a word even twice on a record that seems likely to last forever, then it's important for us to know what it means."

Layon stood up once more.

"All these extra universes and huge shallows and meaningless words1 can't say that they don't exist, but I don't see what difference it makes," he said. "The Shars of a few generation's ago spent their whole lives breeding better algae crops for us, and showing us how to cultivate them, instead of living haphazardly on bacteria. Farther back, the Shars devised war engines, and war plans. All that was work worth doing. The Lavons of those days evidently got along without the metal plate and its puzzles, and saw to it that the Shars did, too. Well, as far as I'm concerned, you're welcome to the plate, if you like it better than crop improvementbut I think it ought to be thrown away."

"All right," Shar said, shrugging. "If you don't want it, that ends the traditional interview. We'll go our"

There was a rising drone from the table-top. The Para was lifting itself, waves of motion passing over its cilia, like the waves which went silently across the fruiting stalks of the fields of delicate fungi with which the Bottom was planted. It had been so silent that Lavon had forgotten it; he could tell from Shar's startlement that Shar had, too.

"This is a great decision," the waves of sound washing from the creature throbbed. "Every Proto has heard it, and agrees with it. We have been afraid of this metal plate for a long time, afraid that men would learn to understand it and follow what it says to some secret place, leaving the Protos behind. Now we are not afraid."

"There wasn't anything to be afraid of," Lavon said indulgently.

"No Lavon before you, Lavon, had ever said so," the Para said. "We are glad. We will throw the plate away, as Lavon orders."

With that, the shining creature swooped toward the embrasure. With it, it bore away the remaining plate, which had been resting under it on the tabletop, suspended delicately in the curved tips of its supple ventral cilia. Inside its pellucid body, vacuoles swelled to increase its buoyancy and enable it to carry the heavy weight.

With a cry, Shar plunged through the water toward the window.

"Stop, Para!"

i

But Para was already gone, so swiftly that it had not even heard the call. Shar twisted his body and brought up one shoulder against the tower wall. He said nothing. His face was enough. Lavon could not look into it for more than an instant.

The shadows of the two men began to move slowly along the uneven cobbled floor. The Noc descended toward them from the vault, its tentacle stirring the water, its internal light flaring and fading irregularly. It, too, drifted through the window after its cousin, and sank: slowly away toward the Bottom. Gently its living glow dimmed, flickered in the depths, and winked out.

For many days, Lavon was able to avoid thinking much about the loss. There was always a great deal of work to be done. Maintenance of the castles was a never-ending task. The thousand dichotomously-branching wings tended to crumble with time, especially at their bases where they sprouted from one another, and no Shar had yet come forward with a mortar as good as the rotifer-spittle which had once held them together. In addition, the breaking through of windows and the construction of chambers in the early days had been haphazard and often unsound. The instinctive architecture of the Eaters, after all, had not been meant to meet the needs of human occupants.

And then there were the crops. Men no longer fed precariously upon passing bacteria snatched to the mouth; now there were the drifting mats of specific water-fungi and algae, and the mycelia on the Bottom, rich and nourishing, which had been bred by five generations of Shars. These had to be tended constantly to keep the strains pure, and to keep the older and less intelligent species of the Protos from grazing on them. In this latter task, to be sure, the 'more intricate and far-seeing Proto types cooperated, but men were needed to supervise.

There had been a time, after the war with the Eaters, when it had been customary to prey upon the slow-moving and stupid diatoms, whose exquisite and fragile glass shells were so easily burst, and who were unable to learn that a friendly voice did not necessarily mean a friend. There were still people who would crack open a diatom when no one else was looking, but they were regarded as barbarians, to the puzzlement of the Protos. The blurred and simple-minded speech of the gorgeously engraved plants had brought them into the category of community petsa concept which the Protos were utterly unable to grasp, especially since men admitted that diatoms on the half-frustrule were delicious.

Lavon had had to agree, very early, that the distinction was tiny. After all, humans did eat the desmids, which differed from the diatoms only in three particulars: Their shells were flexible, they could not move (and for that matter neither could all but a few groups of diatoms), and they did not speak. Yet to Lavon, as to most men, there did seem to be some kind of distinction, whether the Protos could see it or not, and that was that. Under the circumstances he felt that it was a part of his duty, as the hereditary leader of men, to protect the diatoms from the occasional poachers who

browsed upon them, in defiance of custom, in the high levels of the sunlit sky.

Yet Lavon found it impossible to keep himself busy enough to forget that moment when the last clues to Man's origin and destination had been seized, on authority of his own care-less exaggeration, and borne away into-dim space.

It might be possible to ask Para for the return of the plate, explain that a mistake had been made. The Protos were creatures of implacable logic, but they respected men, were used to illogic in men, and might reverse their decision if pressed

We are sorry. The plate was carried over the bar and released in the gulf. We will have the Bottom there searched, but...

With a sick feeling he could not repress, Lavon knew that that would be the answer, or something very like it. When the Protos decided something was worthless, they did not hide it in some chamber like old women. They threw it away efficiently.

Yet despite the tormenting of his conscience, Lavon was nearly convinced that the plate was well lost. What had it ever done for Man, except to provide Shais with useless things to think about in the late seasons of their lives? What the Shars themselves had done to benefit Man, here, in the water, in the world, in the universe, had been done by direct experimentation. No bit of useful knowledge had ever come from the plates. There had never been anything in the second plate, at least, but things best left unthought. The Protos were right.

Lavon shifted his position on the plant frond, where he had been sitting in order to overlook the harvesting of an experimental crop of blue-green, oil-rich algae drifting in a clotted mass close to the top Of the sky, and scratched his back gently against the coarse bole. The Protos were seldom wrong, after all. Their lack of creativity, their inability to think an original thought, was a gift as well as a limitation. It allowed them to see and feel things at all times as they werenot as they hoped they might be, for they had no ability to hope, either.

"La-voni Laa-vah-on!"

The long halloo came floating up from the sleepy depths. Propping one hand against the top of the frond, Lavon bent and looked down. One of the harvesters was looking up at him, holding loosely the adze with which he had been splitting free from the raft the glutinous tetrads of the algae.

"I'm up here. What's the matter?"

"We have the ripened quadrant cut free. Shall we tow it away?"

"Tow it away," Lavon said, with a lazy gesture. He leaned back again. At the same instant, a brilliant reddish glory burst into being above him, and cast itself down toward the depths like mesh after mesh of the finest-drawn gold. The great light which lived above the sky during the day, brightening or dimming according to some pattern no Shar ever had fathomed, was blooming again.

Few men, caught in the warm glow of that light, could resist looking up at it especially when the top of the sky itself wrinkled and smiled just a moment's climb or swim away. Yet, as always, Lavon's bemused upward look gave him back nothing but his own distorted, hobbling reflection, and a re-

flection of the plant on which he rested.

Here was the upper limit, the third of the three surfaces of the universe. The first surface was the Bottom, where the water ended.

The second surface was the thermocline, definite enough in summer to provide good sledding, but easily penetrable if you knew how.

The third surface was the sky. One could no more pass through that surface than one could penetrate the Bottom, nor was there any better reason to try. There the universe ended. The light which played over it daily, waxing and waning as it chose, seemed to be one of its properties.

Toward the end of the season, the water gradually became colder and more difficult to breathe, while at the same time the light grew duller and stayed for shorter periods between darkneses. Slow currents started to move. The high waters turned chill and started to fall. The Bottom mud stirred and smoked away, carrying with it the spores of the fields of fungi. The thermocline tossed, became choppy, and melted away. The sky began to fog with particles of soft silt carried up from the Bottom, the walls, the corners of the universe. Before very long, the whole world was cold, inhospitable, flocculent with yellowing, dying creatures. The world died until the first tentative current of warm water broke the winter silence.

That was how it was when the second surface vanished. If the sky were to melt away . . .

"Lavoni"

Just after the long call, a shining bubble rose past Lavon. He reached out and poked it, but it bounded away from his sharp thumb. The gas bubbles which rose from the Bottom in late summer were almost invulnerable and when some especially hard blow or edge did penetrate them, they broke into smaller bubbles which nothing could touch, leaving behind a remarkably bad smell.

Gas. There was no water inside a bubble. A man who got inside a bubble would have nothing to breathe.

But, of course, it was impossible to enter a bubble. The surface tension was too strong. As strong as Shar's metal plate. As strong as the top of the sky.

As strong as the top of the sky. And above that once the bubble was broken a world of gas instead of water? Were all worlds bubbles of water drifting in gas?

If it were so, travel between them would be out of the question, since it would be impossible to pierce the sky to begin with. Nor did the infant cosmography include any provisions for Bottoms for the worlds.

And yet some of the local creatures did burrow *into* the Bottom, quite deeply, seeking something in those depths which was beyond the reach of Man. Even the surface of the ooze, in high summer, crawled with tiny creatures for which mud was a natural medium. And though many of the entities with which man lived could not pass freely between the two countries of water which were divided by the thermocline, men could and did.

And if the new universe of which Shar had spoken existed at all, it had to exist beyond the sky, where the light was. Why could not the sky be passed, after all? The fact that bubbles could sometimes be broken showed that the surface skin had formed between water and gas wasn't completely in-

vulnerable. Had it ever been tried?

Lavon did not suppose that one man could butt his way through the top of the sky, any more than he could burrow into the Bottom, but there might be ways around <he difficulty. Here at his back, for instance, was a plant which gave every appearance of continuing beyond the sky; its upper fronds broke off and were bent back only by a trick of reflection.

It had always been assumed that the plants died where they touched the sky. For the most part, they did, for frequently the dead extension could be seen, leached and yellow, the boxes of its component cells empty, floating unbedded in the perfect mirror. But some were simply chopped off, like the one which sheltered him now. Perhaps that was only an illusion, and instead it soared indefinitely into some other placesome place where men might once have been born, and might still live ...

Both plates were gone. "There was only one other way to find out.

Determinedly, Lavon began to climb toward the wavering mirror of the sky. His thorn-thumbed feet trampled obliviously upon the clustered sheaths of fragile stippled diatoms. The tulip-heads of Vortae, placid and murmurous cousins of Para, retracted startledly out of his way upon coiling stalks, to make silly gossip behind him.

Lavon did not hear them. He continued to climb doggedly toward the light, his fingers and toes gripping the plant-bole.

"Lavon! Where are you going? Lavoni!"

He leaned out and looked down. The man with the adze, a doll-like figure, was beckoning to him from a patch of blue-green retreating over a violet abyss. Dizzily he looked away, clinging to the bole; he had never been so high before. He had, of course, nothing to fear from falling, but the fear was in his heritage. Then he began to climb again.

After a while, he touched the sky with one hand. He stopped to breathe. Curious bacteria gathered about the base of his thumb where blood from a small cut was fogging away, scattered at his gesture, and wriggled mindlessly back toward the dull red lure.

He waited until he no longer felt winded, and resumed climbing. The sky pressed down against the top of his head, against the back of his neck, against his shoulders. It seemed to give slightly, with a tough, frictionless elasticity. The water here was intensely bright, and quite colorless. He climbed another step, driving his shoulders against that enormous weight.

It was fruitless. He might as well have tried to penetrate a cliff.

Again he had to rest. While he panted, he made a curious discovery. All around the bole of the water plant, the steel surface of the sky curved upward, making a kind of sheath. He found that he could insert his hand into itthere was almost enough space to admit his head as well. Clinging closely to the bole, he looked up into the inside of the sheath, probing it with his injured hand. The glare was blinding.

There was a tind of soundless explosion. His whole wrist was suddenly encircled in an intense, impersonal grip, as if it were being cut in two. In blind astonishment, he lunged upward.

The ring of pain travelled smoothly down his upflung arm

as he rose, was suddenly around his shoulders and chest. Another lunge and his knees were being squeezed in the circular vise. Another

Something was horribly wrong. He clung to the bole and tried to gasp, but there was nothing to breathe.

The water came streaming out of his body, from his mouth, his nostrils, the spiracles in his sides, spurting in tangible jets. An intense and fiery itching crawled over the surface of his body. At each spasm, long knives ran into him, and from a great distance he heard more water being expelled from his book-lungs in an obscene, frothy sputtering. Inside his head, a patch of fire began to eat away at the floor of his nasal cavity.

Lavon was drowning:

With a final convulsion, he kicked himself away from the splintery bole, and fell. A hard impact shook him; and then the water, who had clung to him so tightly when he had first attempted to leave her, took him back with cold violence.

Sprawling and tumbling grotesquely, he drifted, down and down and down, toward the Bottom.

For many days, Lavon lay curled insensibly in his spore, as if in the winter sleep. The shock of cold which he had felt on re-entering his native universe had been taken by his body as a sign of coming winter, as it had taken the oxygen-starvation of his brief sojourn above the sky. The spore-forming glands had at once begun to function.

Had it not been for this, Lavon would surely have died. The danger of drowning disappeared even as he fell, as the air bubbled out of his lungs and readmitted the life-giving water. But for acute desiccation and third degree sunburn, the sunken universe knew no remedy. The healing amniotic fluid generated by the spore-forming glands, after the transparent amber sphere had enclosed him, offered Lavon his only chance.

The brown sphere, quiescent in the eternal winter of the Bottom, was spotted after some days by a prowling ameba. Down there the temperature was always an even 4, no matter what the season, but it was unheard of that a spore should be found there while the high epilimnion was still warm and rich in oxygen.

Within an hour, the spore was surrounded by scores of astonished protos, jostling each other to bump their blunt eyeless prows against the shell. Another hour later, a squad of worried men came plunging from the castles far above to press their own noses against the transparent wall. Then swift orders were given.

Four Paras grouped themselves about the amber sphere, and there was a subdued explosion as their trichocysts burst. The four Paras thrummed and lifted, tugging.

Lavon's spore swayed gently in the mud and then rose slowly, entangled in the fine web. Nearby, a Noc cast a cold pulsating glow over the operation, for the benefit of the baffled knot of men. The sleeping figure of Lavon, head bowed, knees drawn up into its chest, revolved with an absurd solemnity inside the shell as it was moved.

"Take him to Shar, Para."

The young Shar justified, by minding his own business, the traditional wisdom with which his hereditary office had invested him. He observed at once that there was nothing he

could do for the encysted Lavon which would not be classifiable as simple meddling.

He had the sphere deposited in a high tower room of his castle, where there was plenty of light and the water was warm, which should suggest to the estivating form that spring was again on the way. Beyond that, he simply sat and watched, and kept his speculations to himself.

Inside the spore, Lavon's body seemed to be rapidly shedding its skin, in long strips and patches. Gradually, his curious shrunkenness disappeared. His withered arms and legs and sunken abdomen filled out again.

The days went by while Shar watched. Finally he could discern no more changes, and, on a hunch, had the spore taken up to the topmost battlements of the tower, into the direct daylight.

An hour later, Lavon moved in his amber prison.

He uncurled and stretched, turned blank eyes up toward the light. His expression was that of a man who had not yet awakened from a ferocious nightmare. His whole body shone with a strange pink newness.

Shar knocked gently on the walls of the spore. Lavon turned his blind face toward the sound, life coming into his eyes. He smiled tentatively and braced his hands and feet against the inner wall of the shell.

The whole sphere fell abruptly to pieces with a sharp crackling. The amniotic fluid dissipated around him and Shar, carrying away with it the suggestive odor of a bitter struggle against death.

Lavon stood among the shards and looked at Shar silently. At last he said:

"Shar I've been above the sky."

"I know," Shar said gently.

Again Lavon was silent. Shar said, "Don't be humble, Lavon. You've done an epoch-making thing. It nearly cost you your life. You must tell me the rest of it."

"The rest?"

"You taught me a lot while you slept. Or are you still opposed to 'useless' knowledge?"

Lavon could say nothing. He no longer could tell what he knew from what he wanted to know. He had only one question left, but he could not utter it. He could only look dumbly into Shar's delicate face.

"You have answered me," Shar said, even more gently than before. "Come, my friend; join me at my table. We will plan our journey to the stars."

There were five of them around Shar's big table: Shar himself, Lavon, and the three assistants assigned by custom to the Shars from the families Than, Tanol and Stravol. The duties of these three men, sometimes, women under many previous Shars had been simple and onerous: to put into effect in the field the genetic changes in the food crops which the Shar himself had worked out in little, in laboratory tanks and flats. Under other Shars more interested in metalworking or in chemistry, they had been smudged mendigers, rock-splitters, fashioners and cleaners of apparatus.

Under Shar XVI, however, the three assistants had been more envied than usual among the rest of Lavon's people, for they seemed to do very little work of any kind. They spent long hours of every day talking with Shar in his chambers, poring over records, making miniscule scratch-marks on slate,

or just looking intently at simple things about which there was no obvious mystery. Sometimes they actually worked with Shar in his laboratory, but mostly they just sat.

Shar XVI had, as a matter of fact, discovered certain rudimentary rules of inquiry which, as he explained it to Lavon, he had recognized as tools of enormous power. He had become more interested in passing these on to future workers than in the seductions of any specific experiment, the journey to the stars perhaps excepted. The Than, Tanol and Stravol of his generation were having scientific method pounded into their heads, a procedure they maintained was sometimes more painful than heaving a thousand rocks.

That they were the first of Lavon's people to be taxed with the problem of constructing a spaceship was, therefore, inevitable. The results lay on the table: three models, made of diatom-glass, strands of algae, flexible bits of cellulose, flakes of stonewort, slivers of wood, and organic glues collected from the secretions of a score of different plants and animals.

Lavon picked up the nearest one, a fragile spherical construction inside which little beads of dark-brown lava-actually bricks of rotifer-spittle painfully chipped free from the wall of an unused castle moved freely back and forth in a kind of ball-bearing race. "Now whose is this one?" he said, turning the sphere curiously to and fro.

"That's mine," Tanol said. "Frankly, I don't think it comes anywhere near meeting all the requirements. It's just the only design I could arrive at that I think we could build with the materials and knowledge we have to hand now."

"But how does it work?"

"Hand it here a moment, Lavon. This bladder you see inside at the center, with the hollow spirogyra straws leading out from it to the skin of the ship, is a buoyancy tank. The idea is that we trap ourselves a big gas-bubble as it rises from the Bottom and install it in the tank. Probably we'll have to do that piecemeal. Then the ship rises to the sky on the buoyancy of the bubble. The little paddles, here along these two bands on the outside, rotate when the crewfiat's these bricks you hear shaking around insidewalks a treadmill that runs around the inside of the hull; they paddle us over to the edge of the sky. I stole that trick from the way Didin gets about. Then we pull the paddles in they fold over into slots, like this and, still by weight-transfer from the inside, we roll ourselves up the slope until we're out in space. When we hit another world and enter the water again, we let the gas out of the tank gradually through the exhaust tubes represented by these straws, and sink down to a landing at a controlled rate." "Very ingenious," Shar said thoughtfully. "But I can foresee some difficulties. For one thing, the design lacks stability."

"Yes, it does," Tanol agreed. "And keeping it in motion is going to require a lot of footwork. But if we were to sling a freely-moving weight from the center of gravity of the machine, we could stabilize it at least partly. And the biggest expenditure of energy involved in the whole trip is going to be getting the machine up to the sky in the first place, and with this design that's taken care of as a matter of fact, once the bubble's installed, we'll have to keep the ship tied down until we're ready to take off."

"How about letting the gas out?" Lavon said. "Will it go out through those little tubes when we want it to? Won't it just cling to the walls of the tubes instead? The skin between

water and gas is pretty difficult to deform to that I can testify."

Tanol frowned. "That I don't know. Don't forget that the tubes will be large in the real ship, not just straws as they are in the model."

"Bigger than a man's body?" Than said.

"No, hardly. Maybe as big through as a man's head, at the most."

"Won't work," Than said tersely. "I tried it. You can't lead a bubble through a pipe that small. As Lavon says, it clings to the inside of the tube and won't be budged unless you put pressure behind it lots of pressure. If we build this ship, we'll just have to abandon it once we hit our new world; we won't be able to set it down anywhere."

"That's out of the question," Lavon said at once. "Putting aside for the moment the waste involved, we may have to use the ship again in a hurry. Who knows what the new world will be like? We're going to have to be able to leave it again if it turns out to be impossible to live in."

"Which is your model, Than?" Shar said.

"This one. With this design, we do the trip the hard way crawl along the Bottom until it meets the sky, crawl until we hit the next world, and crawl wherever we're going when we get there. No aquabatics. She's treadmill-powered, like Tanol's, but not necessarily man-powered; I've been thinking a bit about using motile diatoms. She steers by varying the power on one side or the other. For fine steering we can also hitch a pair of thongs to opposite ends of the rear axle and swivel her that way."

Shar looked closely at the tube-shaped model and pushed it experimentally along the table a little way. "I like that," he said presently. "It sits still when you want it to. With Than's spherical ship, we'd be at the mercy of any stray current at home or in the new world and for all I know there may be currents of some sort in space, too, *ga* currents perhaps. Lavori, what do you think?"

"How would we build it?" Lavon said. "It's round in cross-section. That's all very well for a model, but how do you make a really big tube of that shape that won't fall in on itself?"

"Look inside, through the front window," Than said.

"You'll see beams that cross at the center, at right angles to the long axis. They hold the walls braced."

"That 'consumes a lot of space," Stravol objected. By far the quietest and most introspective of the three assistants, he had not spoken until now since the beginning of the conference. "You've got to have free passage back and forth inside the ship. How are we going to keep everything operating if we have to be crawling around beams all the time?"

"All right, come up with something better," Than said, shrugging.

"That's easy. We bend hoops."

"Hoops!" Tanol said. "On *that* scale? You'd have to soak your wood in mud for a year before it would be flexible enough, and then it wouldn't have the strength you'd need."

"No, you wouldn't," Stravol said. "I didn't build a ship model, I just made drawings, and my ship isn't as good as Than's by a long distance. But my design for the ship is also tubular, so I did build a model of a hoop-bending machine that's it on the table. You lock one end of your beam down in a heavy vise, like so, leaving the butt striking out on the other

side. Then you tie up the other end with a heavy line, around this notch. Then you run your line around a windlass, and five or six men wind up the windlass, like so. That pulls the free end of the beam down until the notch engages with this key-slot, which you've pro-cut at the other end. Then you unlock the vise, and there's your hoop; for safety you might drive a peg through the joint to keep the thing from springing open unexpectedly."

"Wouldn't the beam you were using break after it had bent a certain distance?" Lavon asked.

"Stock timber certainly would," Stravol said. "But for this trick you use *green* wood, not seasoned. Otherwise you'd have to soften your beam to uselessness, as Tanol says. But live wood will flex enough to make a good, strong, single-unit hoop or if it doesn't, Shar, the little rituals with numbers that you've been teaching us don't mean anything after all!"

Shar smiled. "You can easily make a mistake in using numbers," he said.

"I checked everything."

"I'm sure of it. And I think it's well worth a trial. Anything else to offer?"

"Well," Stravol said, "I've got a kind of live ventilating system I think should be useful. Otherwise, as I said, Than's ship strikes me as the type we should build; my own's hopelessly cumbersome."

"I have to agree," Tanol said regretfully. "But I'd like to try putting together a lighter-than-water ship sometime, maybe just for local travel. If the new world is bigger than ours, it might not be possible to swim everywhere you might want to go."

"That never occurred to me," Lavon exclaimed. "Suppose the new world *is* twice, three times, eight times as big as ours? Shar, is there any reason why that couldn't be?"

"None that I know of. The history plate certainly seems to take all kinds of enormous distances practically for granted. All right, let's make up a composite design from what we have here. Tanol, you're the best draftsman among us, suppose you draw it up. Lavon, what about labor?"

"I've a plan ready," Lavon said. "As I see it, the people who work on the ship are going to have to be on the job full time. Building the vessel isn't going to be an overnight task, or even one that we can finish in a single season, so we can't count on using a rotating force. Besides, this is technical work; once a man learns how to do a particular task, it would be wasteful to send him back to tending fungi just because somebody else has some time on his hands."

"So I've set up a basic force involving the two or three most intelligent hand-workers from each of the various trades. Those people I can withdraw from their regular work without upsetting the way we run our usual concerns, or noticeably increasing the burden on the others in a given trade. They will do the skilled labor, and stick with the ship until it's done. Some of them will make up the crew, too. For heavy, unskilled jobs, we can call on the various seasonal pools of unskilled people without disrupting our ordinary life."

"Good," Shar said. He leaned forward and rested linked hands on the edge of the table although, because of the webbing between his fingers, he could link no more than the fingertips. "We've really made remarkable progress. I didn't expect that we'd have matters advanced a tenth as far as this

by the end of this meeting. But maybe I've overlooked something important. Has anybody any more suggestions, or any questions?"

"I've got a question," Stravol said quietly.

"All right, let's hear it."

"Where are we going?"

There was quite a long silence. Finally Shar said: "Stravol, I can't answer that yet. I could say that we're going to the stars, but since we still have no idea what a star is, that answer wouldn't do you much good. We're going to make this trip because we've found that some of the fantastic things that the history plate says are really so. We know now that the sky can be passed, and that beyond the sky there's a region where there's no water to breathe,, the region our ancients called 'space.' Both of these ideas always seemed to be against common sense, but nevertheless we've found that they're true.

"The history plate also says that there are other worlds than ours, and actually that's an easier idea to accept, once you've found out that the other two are so. As for the stars well, we just don't know yet, we haven't any information at all that would allow us to read the history plate on that subject with new eyes, and there's no point in making wild guesses unless we can test the guesses. The stars are in space, and presumably, once we're out in space, we'll see them and the meaning of the word will become clear. At least we can confidently expect to see some clues look at all the information we got from Lavon's trip of a few seconds above the sky

"But in the meantime, there's no point in our speculating in a bubble. We think there are other worlds somewhere, and we're devising means to make the trip. The other questions, the pendant ones, just have to be put aside for now. We'll answer them eventually there's no doubt in my mind about that. But it may take a long time."

Stravol grinned ruefully. "I expected no more. In a way, I think the whole project is crazy. But I'm in it right out to the end, all the same."

Shar and Lavon grinned back. All of them had the fever, and Lavon suspected that their whole enclosed universe would share it with them before long. He said:

"Then let's not waste a minute. There's still a huge mass of detail to be worked out, and after that, all the hard work will just have begun. Let's get moving!"

The five men arose and looked at each other. Their expressions varied, but in all their eyes there was in addition the same mixture of awe and ambition: the composite face of the shipwright and of the astronaut.

Then they went out, severally, to begin their voyages.

It was two winter sleeps after Lavon's disastrous climb beyond the sky that all work on the spaceship stopped. By then, Lavon knew that he had hardened and weathered into that temporarily ageless state a man enters after he has just reached his prime; and he knew also that there were wrinkles engraved on his brow, to stay and to deepen.

"Old" Shar, too, had changed, his features losing some of their delicacy as he came into his maturity. Though the wedge-shaped bony structure of his face would give him a withdrawn and poetic look for as long as he lived, participation in the plan had given his expression a kind of executive overlay, which at best made it assume a mask-like rigidity, and at

worst coarsened it somehow.

Yet despite the bleeding away of the years, the spaceship was still only a hulk. It lay upon a platform built above the tumbled boulders of the sandbar which stretched out from one wall of the world. It was an immense hull of pegged wood, broken by regularly spaced gaps through which the raw beams of its skeleton could be seen.

Work upon it had progressed fairly rapidly at first, for it was not hard to visualize what kind of vehicle would be needed to crawl through empty space without losing its water; Than and his colleagues had done that job well. It had been recognized, too, that the sheer size of the machine would enforce a long period of construction, perhaps as long as two full seasons; but neither Shar and his assistants nor Lavon had anticipated any serious snag.

For that matter, part of the vehicle's apparent incompleteness was an illusion. About a third of its fittings were to consist of living creatures, which could not be expected to install themselves in the vessel much before the actual takeoff.

Yet time and time again, work on the ship had to be halted for long periods. Several times whole sections needed to be ripped out, as it became more and more evident that hardly a single normal, understandable concept could be applied to the problem of space travel.

The lack of the history plate, which the Para steadfastly refused to deliver up, was a double handicap. Immediately upon its loss, Shar had set himself to reproduce it from memory; but unlike the more religious of his ancestors, he had never regarded it as holy writ, and hence had never set himself to memorizing it word by word. Even before the theft, he had accumulated a set of variant translations of passages presenting specific experimental problems, which were stored in his library, carved in wood. Most of these translations, however, tended to contradict each other, and none of them related to spaceship construction, upon which the original had been vague in any case.

No duplicates of the cryptic characters of the original had ever been made, for the simple reason that there was nothing in the sunken universe capable of destroying the originals, nor of duplicating their apparently changeless permanence. Shar remarked too late that through simple caution they should have made a number of verbatim temporary records but after generations of green-gold peace, simple caution no longer covers preparation against catastrophe. (Nor, for that matter, does a culture which has to dig each letter of its simple alphabet into pulpy water-logged wood with a flake of stonewort encourage the keeping of records in triplicate.)

As a result, Shar's imperfect memory of the contents of the history plate, plus the constant and miUenial doubt as to the accuracy of the various translations, proved finally to be the worst obstacle to progress on the spaceship itself.

"Men must paddle before they can swim," Lavon observed belatedly, and Shar was forced to agree with him.

Obviously, whatever the ancients had known about spaceship construction, very little of that knowledge was usable to a people still trying to build its first spaceship from scratch. In retrospect, it was not surprising that the great hulk rested incomplete upon its platform above the sand boulders, exuding a musty odor of wood steadily losing its strength, two generations after its flat bottom had been laid down.

The fat-faced young man who headed the strike delegation to Shar's chambers was Phil XX, a man two generations younger than Shar, four younger than Lavon. There were crow's-feet at the corners of his eyes, which made him look both like a querulous old man and like an infant spoiled in the spore.

"We're calling a halt to this crazy project," he said bluntly. "We've slaved away our youth on it, but now that we're our own masters, it's over, that's all. It's over."

"Nobody's compelled you," Lavon said angrily.

"Society does-, our parents do," a gaunt member of the delegation said. "But now we're going to start living in the real world. Everybody these days knows that there's no other world but this one. You oldsters can hang on to your superstitions if you like. We don't intend to."

Baffled, Lavon looked over at Shar. The scientist smiled and said, "Let them go, Lavon. We have no use for the faint-hearted."

The fat-faced young man flushed. "You can't insult us into going back to work. We're through. Build your own ship to no place!"

"All' right," Lavon said evenly. "Go on, beat it. Don't stand around here orating about it. You've made your decisions and we're not interested in your self-justifications. Goodbye."

The fat-faced young man evidently still had quite a bit of heroism to dramatize which Lavon's dismissal had short-circuited. An examination of Lavon's stony face, however, seemed to convince him that he had to take his victory as he found it. He and the delegation trailed ingloriously out the archway.

"Now what?" Lavon asked when they had gone. "I must admit, Shar, that I would have tried to persuade them. We do need the workers, after all."

"Not as much as they need us," Shar said tranquilly. "I know all those young men. I think they'll be astonished at the runty crops their fields will produce next season, after they have to breed them without my advice. Now, how many volunteers have you got for the crew of the ship?"

"Hundreds. Every youngster of the generation after Phil's wants to go along. Phil's wrong about the segment of the populace, at least. The project catches the imagination of the very young."

"Did you give them any encouragement?"

"Sure," Lavon said. "I told them we'd call on them if they were chosen. But you can't take that seriously! We'd do badly to displace our picked group of specialists with youths who have enthusiasm and nothing else."

"That's not what I had in mind, Lavon. Didn't I see a Noc in these chambers somewhere? Oh, there he is, asleep in the dome. Noc!"

The creature stirred its tentacle lazily.

"Noc, I've a message," Shar called. "The Protos are to tell all men that those who wish to go to the next world with the spaceship must come to the staging area right away. Say that we can't promise to take everyone, but that only those who help us to build the ship will be considered at all."

The Noc curled its tentacle again, and appeared to go back to sleep.

Lavon turned from the arrangement of speaking-tube mega-

phones which was his control board and looked at Para. "One last try," he said. "Will you give us back the history plate?"

"No, Lavon. We have never denied you anything before. But this we must."

"You're going with us, though, Para. Unless you give us back the knowledge we need, you'll lose your life if we lose ours."

"What is one Para?" the creature said. "We are all alike. This cell will die; but the Protos need to know how you fare on this journey. We believe you should make it without the plate, for in no other way can we assess the real importance of the plate."

"Then you admit you still have it. What if you can't communicate with your fellows once we're out in space? How do you know that water isn't essential to your telepathy?"

The Proto was silent. Lavon stared at it a moment, then turned deliberately back to the speaking tubes. "Everyone hang on," he said. He felt shaky. "We're about to start. Stravol, is the ship sealed?"

"As far as I can tell, Lavon."

Lavon shifted to another megaphone. He took a deep breath. Already the water seemed stifling, although the ship hadn't moved.

"Ready with one-quarter power. . . . One, two, three, *go*."

The whole ship jerked and settled back into place again. The raphe diatoms along the under hull settled into their niches, their jelly treads turning against broad endless belts of crude caddis-worm leather. Wooden gears creaked, stepping up the slow power of the creatures, transmitting it to the sixteen axles of the ship's wheels.

The ship rocked and began to roll slowly along the sand bar. Lavon looked tensely through the mica port. The world flowed painfully past him. The ship canted and began to climb the slope. Behind him, he could feel the electric silence of Shar, Para, and the two alternate pilots. Than and Stravol, as if their gaze were stabbing directly through his body and on out the port. The world looked different, now that he was leaving it. How had he missed all this beauty before?

The slapping of the endless belts and the squeaking and groaning of the gears and axles grew louder as the slope steepened. The ship continued to climb, lurching. Around it, squadrons of men and Protos dipped and wheeled, escorting it toward the sky.

Gradually the sky lowered and pressed down toward the top of the ship.

"A little more work from your diatoms, Tanol," Lavon said. "Boulder ahead." The ship swung ponderously. "All right, slow them up again. Give us a shove from your side, Tolno, that's too much there, that's it. Back to normal; you're still turning us I Tanol, give us one burst to line us up again. Good. All right, steady drive on all sides. It shouldn't be long now."

"How can you think in webs like that?" the Para wondered behind him.

"I just do, that's all. It's the way men think. Overseers, a little more thrust now; the grade's getting steeper."

The gears groaned. The ship nosed up. The sky brightened in Lavon's face. Despite himself, he began to be frightened. His lungs seemed to burn, and in his mind he felt his long

fall through nothingness toward the chill slap of the water as if he were experiencing it for the first time. His skin itched and burned. Could he go up there again? Up there into the burning void, the great gasping agony where no life should go?

The sand bar began to level out and the going became a little easier. Up here, the sky was so close that the lumbering motion of the huge ship disturbed it. Shadows of wavelets ran across the sand. Silently, the thick-barreled bands of blue-green algae drank in the light and converted it to oxygen, writhing in their slow mindless dance just under the long mica skylight which ran along the spine of the ship. In the hold, beneath the latticed corridor and cabin floors, whirring Vortae kept the ship's water in motion, fueling themselves upon drifting organic particles.

One by one, the figures wheeling outside about the ship waved arms or cilia and fell back, coasting down the slope of the sand bar toward the familiar world, dwindling and disappearing. There was at last only one single Euglena, half-plant cousin of the Protos, forging along beside the spaceship into the marshes of the shallows. It loved the light, but finally it, too, was driven away into deeper, cooler waters, its single whiplike tentacle undulating placidly as it went. It was not very bright, but Lavon felt deserted when it left.

Where they were going, though, none could follow.

Now the sky was nothing but a thin, resistant skin of water coating the top of the ship. The vessel slowed, and when Lavon called for more power, it began to dig itself in among the sandgrains and boulders.

"That's not going to work," Shar said tensely. "I think we'd better step down the gear-ratio, Lavon, so you can apply stress more slowly."

"All right," Lavon agreed. "Full stop, everybody. Shar, will you supervise gear-changing, please?"

Insane brilliance of empty space looked Lavon full in the face just beyond his big mica bullseye. It was maddening to be forced to stop here upon the threshold of infinity; and it was dangerous, too. Lavon could feel building in him the old fear of the outside. A few moments more of inaction, he knew with a gathering coldness in his belly, and he would be unable to go through with it.

Surely, he thought, there must be a better way to change gear-ratios than the traditional one, which involved dismantling almost the entire gear-box. Why couldn't a number of gears of different sizes be carried on the same shaft, not necessarily all in action at once, but awaiting use simply by shoving the axle back and forth longitudinally in its sockets? It would still be clumsy, but it could be worked on orders from the bridge and would not involve shutting down the entire machine and throwing the new pilot into a blue-green funk.

Shar came lunging up through the trap and swam himself to a stop.

"All set," he said. "The big reduction gears aren't taking the strain too well, though."

"Splintering?"

"Yes. I'd go it slow at first."

Lavon nodded mutely. Without allowing himself to stop, even for a moment, to consider the consequences of his words, he called: "Half power."

The ship hunched itself down again and began to move,

very slowly indeed, but more smoothly than before. Overhead, the sky thinned to complete transparency. The great light came blasting in. Behind Lavon there was an uneasy stir. The whiteness grew at the front ports.

Again the ship slowed, straining against the blinding barrier. Lavon swallowed and called for more power. The ship groaned like something about to die. It was now almost at a standstill.

"More power," Lavon ground out.

Once more, with infinite slowness, the ship began to move. Gently, it tilted upward.

Then it lunged forward and every board and beam in it began to squall.

"Lavoni Lavon!"

Lavon started sharply at the shout. The voice was coming at him from one of the megaphones, the one marked for the port at the rear of the ship.

"Lavoni"

"What is it? Stop your damn yelling."

"I can see the top of the skyl From the *other* side, from the top side! It's like a big flat sheet of metal. We're going away from. it. We're above the sky, Lavon, we're above the sky!"

Another violent start swung Lavon around toward the forward port. On the outside of the mica, the water was evaporating with shocking swiftness, taking with it strange distortions and patterns made of rainbows.

Lavon saw space.

It was at first like a deserted and cruelly dry version of the Bottom. There were enormous boulders, great cliffs, tumbled, split, riven, jagged rocks going up and away in all directions, as if scattered at random by some giant.

But it had a sky of its own a deep blue dome so far away that he could not believe in, let alone estimate, what its distance might be. And in this dome was a ball of reddish-white fire that seared his eyeballs.

The wilderness of rock was still a long way away from the ship, which now seemed to be resting upon a level, glistening plain. Beneath the surface-shine, the plain seemed to be made of sand, nothing but familiar sand, the same substance which had heaped up to form a bar in Lavon's universe, the bar along which the ship had climbed. But the glassy, colorful skin over it

Suddenly Lavon became conscious of another shout from the megaphone banks. He shook his head savagely and said, "What is it now?"

"Lavon, this is Tol. What have you gotten us into? The belts are locked. The diatoms can't move them. They aren't faking, either; we've rapped them hard enough to make them think we were trying to break their shells, but they still can't give us more power."

"Leave them alone," Lavon snapped. "They can't fake; they haven't enough intelligence. If they say they can't give you more power, they can't."

"Well, then, you get us out of it."

Shar came forward to Lavon's elbow. "We're on a spac&-water interface, where the surface tension is very high," he said softly. "If you order the wheels pulled up now, I think we'll make better progress for a while on the belly tread."

"Good enough," Lavon said with relief. "Hello below haul up the wheels."

"For a long while," Shar said, "I couldn't understand the reference of this history plate to 'retractable landing gear,' but it finally occurred to me that the tension along a space-mud interface would hold any large object pretty tightly. That's why I insisted on our building the ship so that we could lift the wheels."

"Evidently the ancients knew their business after all, Shar."

Quite a few minutes later for shifting power to the belly treads involved another setting of the gear box the ship was crawling along the shore toward the tumbled rock. Anxiously, Lavon scanned the jagged, threatening wall for a break. There was a sort of rivulet off toward the left which might offer a route, though a dubious one, to the next world. After some thought, Lavon ordered his ship turned toward it.

"Do you suppose that thing in the sky is a 'star'?" he asked. "But there were supposed to be lots of them. Only one is up there and one's plenty for my taste."

"I don't know," Shar admitted. "But I'm beginning to get a picture of the way the universe is made, I think. Evidently our world is a sort of cup in the bottom of this huge one. This one has a sky of its own; perhaps it, too, is only a cup in the bottom of a still huger world, and so on and on without end. It's a hard concept to grasp, I'll admit. Maybe it would be more sensible to assume that all the worlds are cups in this one common surface, and that the great light shines on them all impartially."

"Then what makes it go out every night, and dim even in the day during winter?" Lavon demanded.

"Perhaps it travels in circles, over first one world, then another. How could I know yet?"

"Well, if you're right, it means that all we have to do is crawl along here for a while, until we hit the top of the sky' of another world," Lavon said. "Then we dive in. Somehow it seems too simple, after all our preparations."

Shar chuckled, but the sound did not suggest that he had discovered anything funny. "Simple? Have you noticed the temperature yet?"

Lavon had noticed it, just beneath the surface of awareness, but at Shar's remark he realized that he was gradually being stifled. The oxygen content of the water, luckily, had not dropped, but the temperature suggested the shallows in the last and worst part of autumn. It was like trying to breathe soup.

"Than, give us more action from the Vortae," Lavon said. "This is going to be unbearable unless we get more circulation."

There was a reply from Than, but it came to Lavon's ears only as a mumble. It was all he could do now to keep his attention on the business of steering the ship.

The cut or defile in the scattered razor-edged rocks was a little closer, but there still seemed to be many miles of rough desert to cross. After a while, the ship settled into a steady, painfully slow crawling, with less pitching and jerking than before, but also with less progress. Under it, there was now a sliding, grinding sound, rasping against the hull of the ship itself, as if it were treadmilling over some coarse lubricant the particles of which were each as big as a man's head.

Finally Shar said, "Lavon, we'll have to stop again. The sand this far up is dry, and we're wasting energy using the tread."

"Are you sure we can take it?" Lavon asked, gasping for breath. "At least we are moving. If we stop to lower the wheels and change gears again, we'll boil."

"We'll boil if we don't," Shar said calmly. "Some of our algae are dead already and the rest are withering. That's a pretty good sign that we can't take much more. I don't think we'll make it into the shadows, unless we do change over and put on some speed."

There was a gulping sound from one of the mechanics. "We ought to turn back," he said raggedly. "We were never meant to be out here in the first place. We were made for the water, not for this hell."

"We'll stop," Lavon said, "but we're not turning back. That's final." -

The words made a brave sound, but the man had upset Lavon more than he dared to admit, even to himself. "Shar," he said, "make it fast, will you?"

The scientist nodded and dived below.

The minutes stretched out. The great red-gold globe in the sky blazed and blazed. It had moved down the sky, far down, so that the light was pouring into the ship directly in Lavon's face, illuminating every floating particle, its rays like long milky streamers. The currents of water passing Lavon's cheek were almost hot.

How could they dare go directly forward into that inferno? The land directly under the "star" must be even hotter than it was here.

"Lavon! Look at Paral!"

Lavon forced himself to turn and look at his Proto ally. The great slipper had settled to the deck, where it was lying with only a feeble pulsation of its cilia. Inside, its vacuoles were beginning to swell, to become bloated, pear-shaped bubbles, crowding the granulated cytoplasm, pressing upon the dark nuclei.

"Is . . . is he dying?"

"This cell is dying," Para said, as coldly as always. "But go on. There is much to learn, and you may live, even though we do not. **Go** on."

"You're for us now?" Lavon whispered.

"We have always been for you. Push your folly to the uttermost. We will benefit in the end, and so will Man."

The whisper died away. Lavon called the creature again, but it did not respond.

There was a wooden clashing from below, and then Shar's voice came tinnily from one of the megaphones. "Lavon, go ahead! The diatoms are dying, too, and then we'll be without power. Make it as quickly and directly as you can."

Grimly, Lavon leaned forward. "The 'star' is directly over the land we're approaching."

"It is? It may go lower still and the shadows will get longer. That may be our only hope."

Lavon had not thought of that. He rasped into the banked megaphones. Once more, the ship began to move, a little faster now, but seemingly still at a crawl. The thirty-two wheels rumbled.

It got hotter.

Steadily, with a perceptible motion, the "star" sank in Lavon's face. - Suddenly a new terror struck him. Suppose it should continue to go down until it was gone entirely? Blasting though it was now, it was the only source of heat. Would

not space become bitter cold on the instant and the ship an expanding, bursting block of ice?

The shadows lengthened menacingly, stretching across the desert toward the forward-rolling vessel. There was no talking in the cabin, just the sound of ragged breathing and the creaking of the machinery.

Then the jagged horizon seemed to rush upon them. Stony teeth cut into the lower rim of the ball of fire, devoured it swiftly. It was gone.

They were in the lee of the cliffs. Lavon ordered the ship turned to parallel the rock-line; it responded heavily, sluggishly. Far above, the sky deepened steadily, from blue to indigo.

Shar came silently up through the trap and stood beside Lavon, studying that deepening color and the lengthening of the shadows down the beach toward their own world. He said nothing, but Lavon was sure that the same chilling thought was in his mind.

"Lavon."

Lavon jumped. Shar's voice had iron in it. "Yes?"

"We'll have to keep moving. We must make the next world, wherever it is, very shortly."

"How can we dare move when we can't see where we're going? Why not sleep it over if the cold will let us?"

"It will let us," Shar said. "It can't get dangerously cold up here. If it did, the sky or what we used to think of as the sky would have frozen over every night, even in summer. But what I'm thinking about is the water. The plants will go to sleep now. In our world that wouldn't matter; the supply of oxygen there is enough to last through the night. But in this confined space, with so many creatures in it and no supply of fresh water, we will probably smother."

Shar seemed hardly to be involved at all, but spoke rather with the voice of implacable physical laws.

"Furthermore," he said, staring unseeingly out at the raw landscape, "the diatoms are plants, too. In other words, we must stay on the move for as long as we have oxygen and power and pray that we make it."

"Shar, we had quite a few Protos on board this ship once. And Para there isn't quite dead yet. If he were, the cabin would be intolerable. The ship is nearly sterile of bacteria, because all the protos have been eating them as a matter of course and there's no outside supply of them, either. But still and all there would have been some decay."

Shar bent and tested the pellicle of the motionless Para with a probing finger. "You're right, he's still alive. What does that prove?"

"The Vortae are also alive; I can feel the water circulating. Which proves that it wasn't the heat that hurt Para. *it was the light*. Remember how badly my skin was affected after I climbed beyond the sky? Undiluted starlight is deadly. We should add that to the information from the plate."

"I still don't get the point."

"It's this: We've got three or four Noc down below. They were shielded from the light, and so must be still alive. If we concentrate them in the diatom galleys, the dumb diatoms will think it's still daylight and will go on working. Or we can concentrate them up along the spine of the ship, and keep the algae putting out oxygen. So the question is: Which do we need more, oxygen or power? Or can we split the difference?"

Shar actually grinned. "A brilliant piece of thinking. We may make a Shar out of you some day, Lavon. No, I'd say that we can't split the difference. Noc's light isn't intense enough to keep the plants making oxygen; I tried it once, and the oxygen production was too tiny to matter. Evidently the plants use the light for energy. So we'll have to settle for the diatoms for motive power."

"All right. Set it up that way, Shar."

Lavon brought the vessel away from the rocky lee of the cliff, out onto the smoother sand. All trace of direct light was now gone, although there was still a soft, general glow on the sky.

"Now then," Shar said thoughtfully, "I would guess that there's water over there in the canyon, if we can reach it. I'll go below again and arrange"

Lavon gasped.

"What's the matter?"

Silently, Lavon pointed, his heart pounding.

The entire dome of indigo above them was spangled with tiny, incredibly brilliant lights. There were hundreds of them, and more and more were becoming visible as the darkness deepened. And far away, over the ultimate edge of the rocks, was a dim red globe, crescented with ghostly silver. Near the zenith was another such body, much smaller, and silvered all over...

Under the two moons of Hydrot, and under the eternal stars, the two-inch wooden spaceship and its microscopic cargo toiled down the slope toward the drying little rivulet.

The ship rested on the Bottom of the canyon for the rest of the night. The great square doors were unsealed and thrown open to admit the raw, irradiated, life-giving water from outside and the wriggling bacteria which were fresh food.

No other creatures approached them, either out of curiosity or for hunting, while they slept, although Lavon had posted guards at the doors just in case. Evidently, even up here on the very floor of space, highly organized creatures were quiescent at night.

But when the first flush of light filtered through the water, trouble threatened.

First of all, there was the bug-eyed monster. The thing was green and had two snapping claws, either one of which could have broken the ship in two like a spirogyra strand. Its eyes were black and globular, on the ends of short columns, and its long feelers were thicker than a plant bole. It passed in a kicking fury of motion, however, never noticing the ship at all.

"Is that a sample of the kind of life they have here?" Lavon whispered. "Does it all run as big as that?" Nobody answered, for the very good reason that nobody knew.

After a while, Lavon risked moving the ship forward against the current, which was slow but heavy. Enormous writhing worms whipped past them. One struck the hull a heavy blow, then thrashed on obliviously.

"They don't notice us," Shar said. "We're too small. Lavon, the ancients warned us of the immensity of space, but even when you see it, it's impossible to grasp. And all those stars can they mean what I think they mean? It's beyond thought, beyond belief!"

"The Bottom's sloping," Lavon said, looking ahead intently.

"The walls of the canyon are retreating, and the water's *becoming* rather silty. Let the stars wait, Shar; we're coming toward the entrance of our new world."

Shar subsided moodily. His vision of space apparently had disturbed him, perhaps seriously. He took little notice of the great thing that was happening, but instead huddled worriedly over his own expanding speculations. Lavon felt the old gap between their minds widening once more.

Now the Bottom was tilting upward again. Lavon had no experience with delta-formation, for no rivulets left his own world, and the phenomenon worried him. But his worries were swept away in wonder as the ship topped the rise and nosed over.

Ahead, the Bottom sloped away again, indefinitely, into glimmering depths. A proper sky was over them once more, and Lavon could see small rafts of plankton floating placidly beneath it. Almost at once, too, he saw several of the smaller kinds of Protos, a few of which were already approaching the ship

Then the girl came darting out of the depths, her features blurred and distorted with distance and terror. At first she did not seem to see the ship at all. She came twisting and turning lithely through the water, obviously hoping only to throw herself over the mound of the delta and into the savage streamlet beyond.

Lavon was stunned. Not that there were men here he had hoped for that, had even known somehow that men were everywhere in the universe but at the girl's single-minded flight toward suicide.

"What"

Then a dim buzzing began to grow in his ears, and he understood.

"Shar! Than! Stravoll!" he bawled. "Break out crossbows and spears! Knock out all the windows!" He lifted a foot and kicked through the port in front of him. Someone thrust a crossbow into his hand.

"What?" Shar blurted. "What's the matter? What's happening?"

"Eaters!"

The cry went through the ship like a galvanic shock. The rotifers back in Lavon's own world were virtually extinct, but everyone knew 'thoroughly the grim history of the long battle man and Proto had waged against them.

The girl spotted the ship suddenly and paused, obviously stricken with despair at the sight of this new monster. She drifted with her own momentum, her eyes alternately fixed upon the ship and jerking back over her shoulder, toward where the buzzing snarled louder and louder in the dimness.

"Don't stop!" Lavon shouted. "This way, this way! We're friends! We'll help!"

Three great semi-transparent trumpets of smooth flesh bored over the rise, the many thick cilia of their coronas whirring greedily. Dicrans, arrogant in their flexible armor, quarreling thickly among themselves as they moved, with the few blurred, pre-symbolic noises which made up their own language.

Carefully, Lavon wound the crossbow, brought it to his shoulder, and fired. The bolt sang away through the water. It lost momentum rapidly, and was caught by a stray current which brought it closer to the girl than to the Eater at which

Lavon had aimed.

He bit his lip, lowered the weapon, wound it up again. It did not pay to underestimate the range; he would have to wait. Another bolt, cutting through the water from a side port, made him issue orders to cease firing "until," he added, "you can see their eyespots."

The irruption of the rotifers decided the girl. The motionless wooden monster was of course strange to her, but it had not yet menaced her and she must have known what it would be like to have three Dicrans over her, each trying to grab from the others the largest share. She threw herself towards the bullseye port. The three Eaters screamed with fury and greed and bored in after her.

She probably would not have made it, had not the dull vision of the lead Dicran made out the wooden shape of the ship at the last instant. The Dicran backed off, buzzing, and the other two sheered away to avoid colliding with her. After that they had another argument, though they could hardly have formulated what it was that they were fighting about; they were incapable of exchanging any thought much more complicated than the equivalent of "Yaah," "Drop dead," and "You're another."

While they were still snarling at each other, Lavon pierced the nearest one aU the way through with an arablant bolt. The surviving two were at once involved in a lethal battle over the remains.

"Than, take a party out and spear me those two Eaters while they're still fighting," Lavon ordered. "Don't forget to destroy their eggs, too. I can see that this world needs a little taming."

The girl shot through the port and brought up against the far wall of the cabin, flailing in terror. Lavon tried to approach her, but from somewhere she produced a flake of stonewort chipped to a nasty point. Since she was naked, it was hard to tell where she had been hiding it, but she obviously knew how to use it, and meant to. Lavon retreated and sat down on the stool before his control board, waiting while she took in the cabin, Lavon, Shar, the other pilots, the senescent Para.

At last she said: "Are you the gods from beyond the sky?"

"We're from beyond the sky, all right," Lavon said. "But we're not gods. We're human beings, just like you. Are there many humans here?"

The girl seemed to assess the situation very rapidly, savage though she was. Lavon had the odd and impossible impression that he should recognize her: a tall, deceptively relaxed, tawny woman, not after all quite like this one . . . a woman from another world, to be sure, but still . . .

She tucked the knife back into her bright, matted hairaha, Lavon thought confusedly, there's a trick I may need to remember and shook her head.

"We are few. The Eaters are everywhere. Soon they will have the last of us."

Her fatalism was so complete that she actually did not seem to care.

"And you've never cooperated against them? Or asked the Protos to help?"

"The Protos?" She shrugged. "They are as helpless as we are against the Eaters, most of them. We have no weapons that kill at a distance, like yours. And it's too late now for

such weapons to do any good. We axe too few, the Eaters too many."

Labon shook his head emphatically. "You've had one weapon that counts, all along. Against it, numbers mean nothing. We'll show you how we've used it. You may be able to use it even better than we did, once you've given it a try."

The girl shrugged again. "We dreamed of such a weapon, but never found it Are you telling the truth? What is the weapon?"

"Brains, of course," Lavon said. "Not just one brain, but a lot of them. Working together. Cooperation."

"Lavon speaks the truth," a weak voice said from the deck.

The Para stirred feebly. The girl watched it with wide eyes. The sound of the Para using human speech seemed to impress her more than the ship itself, or anything else that it contained.

"The Eaters can be conquered," the thin, burring voice said. "The Protos will help, as they helped in the world from which we came. The Protos fought this flight through space, and deprived Man of his records; but Man made the trip without the records. The Protos will never oppose Man again. We have already spoken to the Protos of this world, and have told them that what Man can dream, Man can do. Whether the Protos will it or not.

"Shar your metal record is with you. It was hidden in the ship. My brothers will lead you to it.

"This organism dies now. It dies in confidence of knowledge, as an intelligent creature dies. Man has taught us this. There is nothing. That knowledge. Cannot do. With it . . . men . . ." have crossed . . . have crossed space . . ."

The voice whispered away. The shining slipper did not change, but something about it was gone. Lavon looked at the girl; their eyes met. He felt an unaccountable Warmth.

"We have crossed space," Lavon repeated softly.

Shar's voice came to him across a great distance. The young-old man was whispering: "Buthave we?"

Lavon was looking at the girl. He had no answer for Shar's question. It did not seem to be important.