

FUTURE

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Robert W.
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Editor

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"None of the constellations are familiar," Dutro said.

EQUATIONS FOR DESTINY



BOWDITCH asked, "You have found a backer?"

Dutro nodded, his long, sardonic face glowing with triumph.

"Another university?" the slight, balding physicist asked, his voice clouded with doubt.

"No," said Dutro. "I am leaving the ivory tower; I have found backing in private industry." The lean, angular face of the psychologist creased in a cruel smile.

"Private industry?" parroted Bowditch. "I don't understand what their interest could be in so pure a form of research."

"Is it necessary that you understand?" Bowditch ignored his tone; one made allowances for a great mind. Dutro stretched erect to his full two meters. "What this University could not see, a great industry has realized. The creative possibilities of this venture—in what you call pure research—are limitless. My electronic computer will make its user supreme in any field of science he chooses."

The psychologist's sardonic grin deepened. "I hope you will not be hurt to learn that the first problems we will put to the Brain will be in applied physics, your own field. I have backers because they believe

There are things the human mind is incapable of, by its very nature. But can the mind contrive a machine to accomplish such things?

that, with the aid of the electronic computer, I will be a greater physicist than you. I have left the ivory tower by virtue of the sheer lack of power of the unaided human brain." His grin became disdainful as he finished.

"I have no doubt of it," murmured Bowditch, willing to give soft insult.

Dutro's face froze in a momentary spasm of rage. "You fail to understand, of course," he said raspingly. "My backers know my electronic computer can solve any problem men have enough sense to put to it." He half-turned to go. "Our first computation will be the fields required to nullify gravity."

Bowditch's short, sharp laugh brought Dutro back. His large, yellow teeth showed through his drawn-back lips. "Don't laugh at me!" he raged. "Only the flaws in your mind make you unable to compute them yourself. My computer has the perfection of a machine. An electron has no emotions, no past, no environment, no shoddy heredity, stained with the blood of a thousand decadent generations of humans! It will tell us!" Dutro struck Bowditch's desk with each phrase. His wild black eyes blazed; his shock of thick black hair

tumbled down about his high, bony forehead.

"Perhaps so," Bowditch laughed softly. "But what good do you think will come of it? The laws of conservation of energy can't be nullified, Dutro. Let us suppose you find a way to nullify gravity—I am enough of a scientist to admit anything is possible within limits. Even your psychologist's mind must know that the amount of energy required to do so will at least be equal to the work done in levitating any mass. What have you achieved?" His smooth, bland face beamed with tolerant good humor. It faded with Dutro's next words.

"A typical example of human frailty," the psychologist said, his voice etched with scorn. "A semantic nightmare." He shuddered without affectation. "The great sorrow of my life is to know that I am blood brother to every erratic human on this globe."

He spun on his heel to leave the physicist's office. "Wait," Bowditch called after him.

Dutro stopped at the door. "Well?"

"Where will you be? You know I have always considered your theory of mentation, as applied to your computer, one of the monuments of human thought; I shall be interested in your progress."

Dutro shook his head. "I cannot tell you. My backers have insisted on complete secrecy. For their investment, they naturally expect a monopoly on the fruits of the Brain's thinking. I must ask you to reveal anything I have said to you today."

Bowditch frowned. "Will Miss Giddons have your address? I might wish to reach you by mail."

"No," Dutro said; "Giddons is coming with me."

"You are wise to take her, I imagine," Bowditch said.

"Certainly. She is utterly adept with her hands, a skill I feel sure will be required in operating the controls of the Brain. And she is fully fa-

miliar with all my work in developing the theory of electronic mentation. This much I will do, for you have been as near to a friend as I have had in this life: When the Brain is in operation, I shall advise you what degree of success we have had."



HE STRODE from Bowditch's office, his long legs speeding him down the corridor and out to the campus. He cast one scornful look at the marks of scholastic seclusion about him, and stepped into his car. He gave curt greeting to the broad-shouldered, mannishly-sultered woman who sat at the wheel; no expression crossed her strong face as she put the car in gear and drew away from the curb.

Giddons drove with an impersonal, robot-like skill. She followed Dutro's instructions, looping back over her route so he could make sure they had not been followed. The car barely drew to a stop to let him alight, and surged away powerfully, the moment his feet touched the pavement.

Dutro never failed to feel a liting of spirit when he entered the Transport Tower. Not the highest building in the world, he knew, but for its size, the most soaring and inspiring in its architectural conception. The high-speed elevator's breathless flight tugged at his ambition. Soon—soon the need for such machinery would vanish. With gravity nullified, how high would the highest building reach? To the stars—yes, to the very stars!

Dutro was no longer held up by the defenses surrounding the Director of the Transport Cartel. The moment his tall, angular frame strode into the outer office, there was a quick scurry, and he was wafted through inner offices—private offices—and into Blackburn's own magnificent quar-

ters, half-enclosed in flawless quartz sheets that gave him a commanding view of the lower city.

There were no attorneys present; the preliminaries had long been disposed of. Blackburn wasted not a moment. "These contracts," he snapped, "are in the form agreed on. The first deposit of ten million credits is now in escrow pending execution of these instruments. You are ready to start?"

"At once." Dutro took Blackburn's stylus and rapidly scrawled his large, ungainly signature to the contracts without glancing at their contents. Blackburn's secretary appeared from nowhere, silently, to ink the fingers of the signatories and affix their prints to the triplicate documents.

Dutro looked across the huge expanse of polished rosewood at Blackburn. "You will not see me again until our success has been complete," he told the Director. "Giddons has already left for the surgeon's. Her features will be altered to make her unrecognizable to the small group that might have seen her before. She shall front for me in all matters; I shall personally remain in absolute seclusion until the work is done. The other security matters will be handled as we have agreed. I shall expect you to act on Giddons' requests as if they were my own."

Blackburn nodded. "How long?" he asked curtly.

Dutro shrugged. "It all depends on the kind of help you can hire me. If all of it is the best money can buy, several years, possibly as few as three."

"A long time to cut yourself off from humanity," Blackburn observed.

"That happened years ago," Dutro chuckled hollowly, rising to leave.

HE COULD not remember when the ink had been cleansed from his hands. He stepped from the elevator into the lobby of the Transport Tower and looked wonderingly at his fingertips. They smelled faintly of benzol. The almost-invisible secretary

must have done it, he decided. He began to realize how great his leap of joy and anticipation had been at the closing of the deal. He was free in a way he had never dreamed.

It was not the spate of money, even though his salary as director of the research project was on a par with the millions the electronic brain would cost to build. No, it was his final and tangible triumph over the idea that the human mind was an admirable instrument that filled him with joy. He watched the crowded sidewalk, speculating whether the number of atoms in the universe was any greater than the number of mistaken judgments the minds before him were capable of. He was above hatred for their frailty. His new powers had placed him, for the first time in the history of mankind, in position to extend the powers of humanity beyond the limited scope of the human brain. It was godlike, he decided.

In one brilliant stroke he had remade humanity, peopling it with supermen. A surge of resentment welled briefly in him at the thought that the mob on the pavement showed him no appreciation. But his magnanimity in that moment of triumph was great enough to excuse it, condone it on the grounds of their faulty mental apparatus. No more faulty than his own, he reflected sadly, as he walked to a cab stand. *Or was it?* He, Dutro, was the only human great enough to see past his own incompetence.

He warmed at that thought. It was true, after all, that the only judgment was the negative judgment. It mattered not that one thing was equal to another thing—the great fact, the great discovery was that it was *not equal to a third*. And only he, Dutro, had been able to make that great discrimination about the processes of human mentation.

Dutro did not see Giddons again until her plastic surgery had healed. Going to the rendezvous they had arranged in a distant city, he found she

had artfully contrived to alter the lines of her rugged, masculine body by the addition of padding to her clothing. She gave the appearance of being plump—almost fat—Dutro observed as he walked across the restaurant to her. The disguise was so complete that he would not have known her, had it not been for his recollection of the shape of her muscular calf. He reflected wryly that it was probably the first time in twenty years that any man had been interested in Giddons' calf.

THE SURGERY had certainly not made her any more beautiful, although it had softened and aged the lines of her face. There was a comfortable middle-aged look to her that Dutro knew for sham.

They took a booth together.

"How have things gone, Giddons?" Dutro asked, his face lowered in the menu. He knew she needed no comment on her appearance; she would know his silence for approval.

"Well. The cartel's real-estate staff has picked property near Carson Sink, in Nevada. It has the most stable humidity in the United States. Austin Company will do the contracting work. The heavy electrical contracts will be split among the Big Three in the manner you suggested. They *should* be unable—unless they compare notes very closely—to make any reasonable guess as to the purpose of the equipment. Machinery to make the secret parts is already on order, split between a number of firms." She half turned away from him as she spoke, and her colorless lips barely moved.

"Have you had trouble getting action from the cartel?" Dutro wanted to know.

"Not yet. I will; they treat me as if I were a woman."

"Which you are," Dutro reminded her dutifully, although reserving a small personal doubt.

"True. But I'd rather be treated otherwise."

"No doubt," Dutro said wryly. "Giddons, you were a faultless assistant in the preparatory phases of this work. You must be my right hand these next two years. I shall make the major decisions, but you must execute them. Without your peculiar abilities, we could not handle this project in this manner. By the way, any reason to think Bowditch has connected your activities with me, or you with the Giddons he knows?"

"None."

"Good. I shall trust you to handle all work until Austin is done with the building, and shan't see you until my private apartments in it are complete." He rose to go.

"Dutro," Giddons said.

"Yes?"

"The auditors want to know to whom they should pay the salary of Director of the project."

The tall psychologist's face broke into a cadaverous grin. "To your order, of course. I trust you with my life's work; certainly I can trust you with mere money."



DUTRO WAS able. The millions the cartel was willing to invest in his research had not been allocated by whim. The best advice had agreed that Dutro had devised something bewilderingly ahead of his time, and that he was capable of executing the design he had so marvelously drawn.

His ability transcended any particular kind of problem. The gigantic leap from the ivory tower to running a huge construction program was made with scarcely a false step. He had an uncanny knack for picking an able man, giving him a concrete and challenging job, and leaving him alone

to solve it, being still wise enough to stand staunchly behind the failures of his subordinates. Without fanfare—and through the means of Giddons—he was a driver, in the best sense of the word. He drove men to their finest effort, gauging what was within the powers of each, and not calling for more.

Giddons was the finest example of his ability to develop talent. Behind the expressionless facade of her altered features, the staff of the rapidly building electronic brain soon found a keen mind, if a cool heart. From Dutro she got the sense of when to goad and when to encourage. The staff knew her only as the Assistant Director; encumbered as they were in a dozen other ways by the extreme security regulations of the project, they found it not strange never to deal with the chief of the whole effort.

There were others; the cartel itself found Dutro brilliant men. Electronic technicians they hired to his order. The whole elaborate machinery of a colossus of modern business was at his disposal, and Dutro used it wisely.

But nothing so complicated is quickly done. Even Dutro's patience—strengthened by his supreme confidence in the success of the electronic brain—was strained as the second year of his voluntary imprisonment within the project drew to a close. Giddons' was the only human face he had seen since his windowless, self-contained suite had been finished.

They sat together in the small dining alcove over a meal Dutro had cooked, reviewing progress.

Giddons laid down a sheet of paper. Her bland, rounded face seemed not to have weathered beyond the age given it three years before by the surgeon's knife; her voice was as impersonal as ever. By now Dutro automatically thought of her as a large, middle-aged woman, almost fat.

"Michalis says they are in the final stage. The condenser circuits from

Philco were much better than expected; the balancing is going nicely."

"The final stage," Dutro snapped. "We've been in the final stage for weeks. How much longer?"

Her gesture was the faintest suggestion of a shrug. There was never an excessive movement. "A day. At most a week."

"Good." He looked up. "Anything else?"

"Yes. Bowditch has written to the Project Director, asking an interview."

Dutro allowed his stern visage to crease in the vertical seams that meant he was smiling. "Took him long enough," he chuckled hollowly; "well, let him come."

BOWDITCH must have flown to Nevada, Dutro reflected, for he arrived within hours of Giddons' telegram to him. Outside of the slight, mild physicist, no accurate guess had been made by outsiders of the purpose of the great construction in the desert. Only the power of the cartel had kept Congress from investigating the secret effort and smothered the fears of foreign General Staffs that the project housed a new engine of atomic destruction.

Dutro sometimes regretted the need for secrecy. He wished the scientific world could know the attempt to transcend the limits of the human mind by a devising of a human mind. Dutro relished the paradox of his aim, but his semantic discipline told him it was no paradox, even if Bowditch thought so.

Dutro's office, in his windowless suite within the huge project building, reflected his academic background. He had not surrounded himself with the pelf what was Blackburn's. His quarters were Spartan, although efficient and adequate in every way for his responsibilities. He could feel that Bowditch was at his ease there.

The physicist spoke. "Dutro, I want you to know that not one soul knows why I am here, or what I am

pected to find here. I have been faithful to your request."

Dutro's smile was almost warm. "You were the only one I would trust with as much as I did," he replied. "I suppose you have often wondered where I was?"

"Yes," said Bowditch. "But I made no special effort to find you. It was not until the papers had made so many mentions of this fantastically-secret project, backed by no one knew whom, that I guessed this was your electronic brain." Dutro's long, lean head moved thoughtfully up and down. "How far have you gotten with it?" Bowditch went on.

"Nearly through," Dutro told him.

"Does the Brain occupy this entire enormous structure?" Bowditch asked him.

"Yes," Dutro replied. "Except for this small wing which contains my quarters and our administrative offices."

Bowditch looked around him. "I missed Giddons," he observed; "has she left you?"

Dutro shook his head and grinned at the joke of it. "No. You walked right past her. She is in hiding, like me. Our security precautions were thorough, believe me, Bowditch."

"I do," said the physicist. "But the reason I came here transcended my curiosity about this project. Dutro, I have thought often of what you said to me when you left the University. Often. I have never seen my semantic difficulty. Can you tell me more about this research? You should know now you can trust my discretion."

DUTRO'S face was a hard mask of concentration. "You refer, of course," he asked, "to the specific problem of calculating the fields required to nullify gravity?"

"Yes."

"Very well. When you said that the energy required to nullify gravity would at least be equal to the work done by that nullification, you were

guilty of three fundamental semantic errors. In the first place, in your your mind you identified the idea of nullifying gravity with that of lifting mass *against* gravity. Those things are not the same. The negative judgment must be employed; a discrimination is required. Your second error was to identify gravity with an attraction between objects having mass, on the Newtonian basis. That is perfectly operable hypothesis in a three-dimensional world, but not in our space-time continuum. And there was your third error. You identified the three-dimensional world, in which your experience appears to take place, with the four-dimensional space-time continuum in which existence occurs."

Bowditch's puzzlement was written plain on his face. "I don't follow you."

"Of course not," Dutro sneered. "If you had, you would have solved this problem for yourself. Very simply, it is this: From the standpoint of a four-dimensional space-time continuum, the phenomenon we call 'gravity' can be treated as a distortion in space-time occasioned by the presence of mass. The orbits of the planets, to take a simple case, are geodesics in *space-time*, but we treat them as ellipses in three-dimensional space.

"What is the inference? A field which could remove that distortion would in effect nullify, in the three-dimensional world in which experience takes place, the phenomenon of gravity. I shall call upon the Brain to compute, from all data on four-dimensional space-time, a field which will rectify that distortion. You were wrong in thinking that the nullification of gravity necessarily involves the performance of work. The Brain will be called on to compute a field which will do no work." Dutro stopped, his bony fingers pointed out into space in an evocative gesture.

Bowditch sat in silence. "I underestimated you, Dutro," he said at last. "But I remain confident of two things. They make me believe, without my being able to tell you the pro-

cess of thought that yields these conclusions, that you cannot succeed."

"An intuition, then?" Dutro carped.

"Call it what you will," Bowditch replied evenly, rising to leave. "In the first place, my confidence in the human mind as the ultimate power of creation is unshaken, no matter how strongly you put the case that an electronic brain is superior. Secondly, it can only be a paradox, even if we cannot see it, that the human mind



can contrive a machine which can accomplish things of which that mind is by its nature incapable." He turned to the door, but stopped with his hand on the knob.

"I guess," he went on softly. "I guess this is all another way of putting an idea that is almost mystical. The feeling that anyone with a pride as great as yours must sustain a fall."

"Pride?" Dutro snapped. "I cannot understand that epithet. If anyone is more humble about the inadequacies of humanity than I am..."

"Of course," Bowditch said, smiling sadly. "I did not think you could understand. And your difficulty is not semantic; the irony is, my dear psychologist, that it is psychological." He left, but Dutro sat silently for long minutes behind him, unable to penetrate his remark.

HIS REVERIE was broken by the buzz of his communicator box. "Yes?" he said, depressing the switch.

"The calibration staff reports they are finished," he heard Giddons' featureless voice say. "You said you wished to go personally to the data room."

Dutro's stomach twisted in momentary fear, now that the test was at

last at hand. "I will go with you," he said, his deep baritone voice firm as always. "Have Michalis wait. I wish to meet him."

"Kyoto, too?" asked Giddons.

"Yes."

Dutro felt a twinge of agarophobia as he left the familiar confines of his suite. The two calibration experts were standing at Giddons' desk. She rose as Dutro came forward, bending a little from his height as he reached to shake their hands perfunctorily.

"This is Dutro," she said without obvious feeling. "Chief of the Project. The usual security regulations apply. Mention of his name or existence will call for immediate punitive action against your posted bond and the retained portion of your compensation."

"Well?" asked Dutro.

"It is done," said Michalis, blanching slightly at the vigor of Dutro's gaze.

"We are completely ready?" Dutro asked Giddons. She nodded briefly. Her large body stood perfectly motionless, solid and plump with its padding. But only she kept effortlessly with Dutro's impatient pace down the corridor to the huge windowless room at the heart of the building where data was fed to the Brain and where the required answers could be called for.

Giddons was at home there. Dutro had originally hired her years before because of her reputation in time and motion studies for manual switchboards. Her skills were paramount here. She moved effortlessly to her large chair before the main bank of controls. Before her were the switchboards and punchtape machines at which the operators sat. The full crew of women was present.

Dutro cast his eye farther about the room. It was completely walled in black Insullite panels, divided in a sort of gridwork. Each panel supported hundreds of spindles on which the data spools were to be impaled. Var-

nier controls studded functionally from the insullite below each spindle. Light alloy ladders on rails that ran around the room enabled the operators to scale the walls to insert data spools.

The spindles were largely empty. Dutro turned back to Giddons.

"What data has been fed the Brain?" he asked her curily.

"Everything relating to the four-dimensional space-time continuum. As other sectors were pronounced balanced by Michalis here, I have had the operators punch out data tapes on various unrelated subjects, and have had their impulses recorded in the memory circuits. Of course, all propositions of mathematics have been provided."

Dutro smiled with satisfaction, and turned to Michalis. "You know, my friend of a few moments," he said, "we are at a moment of history. My sense of the dramatic, and of my own importance in history is sufficiently well-developed to know that I am called upon to do something deathless." He turned to Giddons, who was observing him with expressionless closeness.

"Giddons, what is the sum of two and two?" he asked.

"Four," she replied, without thinking.

"That may very well be," Dutro responded smilingly; "see if the electronic brain agrees with your protoplasmic apparatus."

It created a little ruffle. The punch-tape operator shifted as she set up the simple problem. The tape was placed on its spindle. Dutro stood over the "Start" button. Kyoto took a tiny camera from his pocket that whirred in recording the scene. The red "Running" light flashed when Dutro depressed the stud. There was a measurable interval as the "reject" circuits clicked, denoting decisions on the part of the Brain as to what answers were *not* the right one. Dutro

recalled vaguely that this sort of problem was solved by an appeal to the theory of prime numbers, and that the Brain would take as long to perform this simple sum as to add any imaginable quantity of figures.

WITHIN ten seconds, the red light had winked out, and the green "Answer" light came on. Giddons removed the spool bearing the answer tape from the spindle on her desk and swiveled to feed it into the Interpreter. It clacked briefly as it typed the answer in triplicate. One of the punch-tape operators rose half out of her chair in the tense silence that followed its halt, as if to see the result from ten meters away.

Giddons drew the typed sheet from the machine, tore it off on a serrated cutting edge and banded the original to Dutro.

He read: "*Arithmetic. Simple algebraic sum. Two plus two. Sum, four.*"

He raised his eyes to the others. "There you have it. We now know that two and two are four." He stepped forward one pace and held out his hand to the expressionless Giddons. "This is a moment for mutual congratulation," he said. She took his hand without emotion.

"Giddons," Dutro said, his tone resonant. "Will you please feed in the tape for the First Problem." He felt himself capitalize the words. Again he pressed the start stud. The red light lit. The great room burst into sound as the multifarious clatter of reject relays swelled to a crescendo, thousands of them clicking together in a sound more reminiscent of a hive of bees than any other.

Minutes passed. The reject clatter did not diminish. Dutro lifted his eyebrows briefly. "Even at electronic speeds," he announced. "I believe this problem will require some weeks of the Brain's thought." He led Giddons back to her office.



HERE DUTRO was, in a sense wrong. His discovery of his mistake came in Bowditch's presence. The physicist had not left Nevada, and called on Dutro for the second time only two days after his first visit. He could not restrain his impatience beyond the first brief greeting. "Have you gotten any results?" he demanded.

Dutro seethed inwardly. His outward calm was greater than ever, and his words came slowly, almost insultingly. "We seem to have a five-hundred balking average as of this morning," he revealed. "One problem has been solved; the second is still being mulled over by the Brain, and I suppose it will be a couple weeks before we know what kind of progress it is making with it."

"You do have one result, then?"

"Oh, yes. We know that two and two are four."

Bowditch showed his uncertainty. "You are serious?"

Dutro wished he could swear, but he refused to give Bowditch any comfort. "Yes. That was the first problem: the answer took ten seconds. The problem of nullifying gravity has taken two days, so far."

"It is not finished?" Bowditch asked anxiously.

"No. The Brain is still thinking."

Bowditch lowered his gaze for some moments, concentration creasing his forehead. "I am as great a friend—at least on the intellectual plane—as you have in this world. But I am worried for you. And you must listen to me. You are anthropomorphising that machine; it doesn't 'mull' and it doesn't 'think.' It computes, it calculates. My friend, I think you have finally found the concrete limit of the power of the

human mind. Your failure here..."

"Failure!" Dutro shouted.

Bowditch shrugged. "What else? I say that your failure here shows that the human mind cannot contrive a machine which can solve a problem beyond the power of that mind!"

"Mysticism!" Dutro snorted, but for the first time his confidence was shaken. The subdued buzz of the communicator box burst in on their silence.

Dutro removed his blazing glance from Bowditch long enough to lean toward the box. "Yes?" he said.

"Giddons, on two," said the secretary who had replaced Giddons as his window to the outside world.

Dutro pressed the selector button.

"What is it?" he snapped into the phone.

"The reject relays in sectors four thirty-eight and seven forty-one are quiet," he heard Giddons say. Without a word he hung up.

"Come with me!" he ordered Bowditch. The smaller man trotted to keep up with the psychologist's long stride.

When they arrived in the great, black-panelled room the diminution of sound was immediately apparent to Dutro.

"Several other sectors have stopped rejecting," Giddons told them. Dutro and Bowditch found chairs. The bee-hive humming of the relays was still there, but as more and more sectors of the Brain were satisfied with its computations, the humming began to ebb, and soon the individual clicks of the nearer relays could be heard above the general clatter.

Quite suddenly the whole room was silent but for one relay, far down the black board. Its click-click-click sounded evenly, like the ticking of a fine watch. Its tiny noisiness seemed interminable. Dutro had a short moment of doubt that it had really stopped when its clicking ceased.

The red light died and the green flashed above Giddons' desk. She

looked at Dutro, hands still on her controls.

He signalled her to procede. She removed the answer tape reel from its spindle before her and fed it into the Interpreter. For some minutes it clacked, falling silent after it had typed less than thirty lines. Giddons pulled the broad tape farther from the slot, tore the three copies on the serrated edge. Dutro frowned as he took the original from her.

"It should not have been so simple," he said, half to himself. Bowditch bowed his head over the sheet in unashamed curiosity. Four complex electrical integrals had been written by the interpreter.

The physicist shook his head. "Whatever these equations are," he said, "will need another machine to determine. They have no relation to any known system of which I have the slightest knowledge. You have failed after all," he said to Dutro.

GIDDONS had half-risen from her chair. The slightest frown creased between her eyes. At a gesture from Dutro she sank back, looking plump, middle-aged and emotionless.

"I am reminded of Achilles," Dutro said, leaning back in his chair and allowing a smile to purse his chiselled lips. "Was it not his mother who asked an oracle how to proof him against wounds? And did not the oracle tell her to dip him in a pool? And did she not do so—but hold him by the heel? And did he not die of a wound in that heel and she therefore fail? Why? Because the advice of the oracle was bad? Certainly not: Because her question was not complete, or because she failed to understand the answer, which is the same thing."

Hooking his arm over the back of the seat, he swung around to face Bowditch. "What we have here is a specialized solution of the Brain, one that produced nullification of gravity without the attendant performance of work. This equation, Bowditch, must

therefore be one of a family of equations relating to the nullification of gravity under varying conditions of performance of work. A better question will give us the family, all the equations, and from the whole group we can construct the new mathematical discipline needed to implement them."

He stood up. "Giddons, you and I have much work to do." His assistant rose and followed him and Bowditch back to Dutro's office.



Dutro's evaluation had been good. A newly-prepared question-tape, when at last readied, drew forth the same all-prevading clatter of reject relays when the start stud was pressed. After ten days of mentation, during which Giddons scarcely left the controls lest new settings be required at some critical level of mentation in the final stages of the problem, the electronic brain had so little satisfied itself, that not one relay had yet ceased to reject solutions.



Bowditch was a constant caller, learning from day to day that the Brain continued to calculate. He was there when the first relay fell silent, and still there, days later, when the final three relays chattered in a stuttery rhythm of indecision for interminable hours. And, along with Dutro, he watched the decisive part Giddons played in those hours, as tell-tales rang and lit over her complex board. Her movements were so economical and yet so swift that Dutro half-believed she anticipated the signals of her panel.

But at last it was done. This time the answer-tape, when fed into the

Interpreter, drew forth solid hours of typing. When Giddons finally removed several feet of typed tape from the machine and handed the first copy to Dutro, she, Dutro and Bowditch had completed a vigil through two nights and a day.

THE TENSION was not broken by Bowditch's long perusal of the hundreds of integral equations that were listed in an apparent kind of order on the tape. The physicist shook his head.

"I am stunned," he said. "Dutro, I do not know whether to be more in awe of you or this machine you have created. You were right about the equations; the last four on this long sheet are the same as the four indecipherable integrals the machine wrote when the problem was first given to it. I take it there are either four ways to nullify gravity without work, or that four fields must be generated."

"These equations make sense to you, then?" Dutro asked. "I must confess that electrical integrals of this nature are beyond me."

Bowditch turned to the psychologist, his hands outstretched. "Some sense," he admitted. "The first two equations are known to us all. The third is a derivation of the boldest sort, but my preliminary reaction is that it makes complete sense. As to the rest, they seem to follow a pattern, but they are so divorced from any mathematics I have ever dealt with that I would need days of study to evaluate them."

He paused. "How will you use them?" he asked, painily telling Dutro by his question that he had no doubt the equations were in fact the answer Dutro had so long sought.

Dutro had anticipated that pleasure, and his dreamy smile showed it. "I have waited long, and planned carefully, for this moment," he said. "These equations will be turned over to the most brilliant staff of electronic

engineers ever recruited, who will convert their mathematical symbolism into the apparatus required to produce the indicated fields. It is a job in its own way as complicated as the creation of the Brain was in its. And I imagine the Brain will be kept more than busy on the subsidiary problems. In this job, interesting as it might be to turn it loose on many of the other mysteries. Mysteries," he said, turning back to Bowditch. "That are so only because we poor humans are incapable of piercing the thin veil hiding the truth."



Dutro was wrong in his estimate of the difficulty of building the generators described by the equations the Brain had written. Once the new discipline had been absorbed by the electronic engineers, the fabrication of field generators was comparatively an easy job. Long beforehand, Dutro had known the configuration he wanted the equipment to take. He had not known how bulky the generators would be, nor the power needed to run them. To his delight, the completed equipment took the form he had hopefully envisaged, a simple sphere of a hard cobalt-tungsten-nickel alloy, barely six meters in diameter. In addition to its power supply and the generators, the sphere had room within for a crew of two and minimum facilities for a stay within its shell of a few days. Dutro envisaged it as nothing less than a craft—one that soon would be capable of navigating space. As a result, its equipment included what he considered the minimum to permit navigation beyond the atmosphere, and emergency equipment in case it were necessary to abandon the craft.

As Dutro had expected, the Brain had been essential in many of the subsidiary calculations. While he was confident that the effective radius of the field generators was exactly that of the alloy sphere, the whole theory

was so untested that care was indicated in the first trials.



WITH CO-OPERATION from Government agencies, due to the influence of the cartel, use of one of the atomic proving grounds was secured, and equipment for the test moved there by steamer. Bowditch was one of the few outsiders whom Dutro let come with the small test crew.

After days of preparation, the two scientists stood together on the glaring coral sand as Giddons made last preparations with the controls she was to handle during the test.

"What do you expect the physical manifestation of the test will be?" Bowditch asked.

"Probably you will see several things," Dutro confessed. "The significance of that family of equations was quite remarkable, Bowditch. They indicate a sequence of fields which can be generated to nullify progressively greater portions of gravity. It appears that, in total, four fields must be generated, and the mixing of their properties is what controls the amount of gravity nullified. We have generated the fields individually, with no result. No three together have any result. That was all predicted by the Brain, in answer to questions.

"Because we cannot frame questions that seem to make sense to the Brain, however, we have not been able to get any idea of the physical manifestations. In the first test, we have decided to nullify gravity completely, within the limit of the efficiency of the generators, which we think is very high indeed, if not one hundred percent.

"If that succeeds, we will try some of the partial-nullification conditions." He smiled. "I rather think you

will see the sphere shoot upward at a tangent as it flies away, completely cut off from gravity. At least, I trust you will."

"I hope so," Bowditch replied. He held out his hand. "I want to say this before your great triumph, my friend, not afterward," he said in a kindly tone. "I have been wrong throughout this project; I admit it now. You are even greater than I knew."

Dutro took his hand. "Thank you," he said. "I rather think you should get aboard the helicopter. I think Giddons is ready; she just stuck her head out the lock."

Dutro entered the sphere, crouching his tallness to turn to seal the lock. He worked his way carefully in the cramped space to his heavily padded seat beside Giddons. She was already at her control panel, securely strapped in her seat. Dutro looked at her in amazement. She was positively thin.

"What happened to you?" he demanded.

"Had you forgotten, too?" she asked. "It was hard for me to believe when I saw it. But I could see no need for my padding any more. I am wearing some of my old clothes."

"You look amazingly young," Dutro said gallantly as he fastened his harness.

"All but my face," she agreed. "And I shall grow into that. Time passes quickly."

IN A ROUTINE they had practiced many times before, they made a check of the instruments, and brought the field generators up to power. Dutro laid his hand on the switch, as the signal came that all observers were at a safe distance. Far above the coral atoll radio-controlled aircraft recorded the scene by television and direct photography.

"Ready?" Dutro asked.

"Yes," Giddons said.

"Just in case," Dutro said haltingly. "I have enjoyed working with you."

"And so have I," Giddons replied evenly.

Dutro closed the switch. He was instantly weightless, and knew from her slight gasp that Giddons felt the same. There had been no transition, no acceleration or deceleration. He switched on the kitescope and looked in the television screen before him. The lens reported an all-pervading blackness. Tiny flecks of light speckled the fluorescent screen as stray electrons leaking from the field generating equipment impinged on its coating. He surveyed all six directions with equal lack of success.

The phenomenon did not disturb him. What the physical sensations would be, he had been unable to determine from the Brain. They would either be fatal, or not. They were not.

He turned to Giddons, who sat motionless at her panel. Her expressionless face might be slightly pale, Dutro thought. So, perhaps, was his, he was forced to admit to himself.

"Feel all right?" he asked.

"I am becoming oriented to the weightlessness," she said. "For a while..." She made a moue.

Dutro knew how she felt. Every involuntary reflex associated with the idea of falling had leapt at the onset of weightlessness. The sensation of interminable fall was beginning to wear off as the conscious mind began to assert its dominance over the instinctive patterns of a lifetime.

"What is happening?" Giddons asked him.

"My sensations tell me we have nullified gravity. Your instruments say we have; they all seem to read zero."

"That's so," she replied. "That means you have been completely successful?"

"Yes. Have you ever doubted it?"

A slow smile warmed her features, a most unusual occurrence, thought Dutro. "No," she said, her voice colored for once by what Dutro thought was

almost an expression of admiration. "Nothing is beyond you."

Dutro was reluctant to switch off the generators. By his figuring, upon the nullification of gravity the alloy sphere had shot upwards at a tangent to the Earth's surface. He was not anxious to have it fall heavily back to Earth when the power was cut, and thus allowed the generators to produce their nullifying fields for many minutes. They might need time for maneuvering, with various degrees of gravity nullified when it came to the landing.

Dutro watched the stop-clock. When ten minutes had elapsed, he switched off the generators. There was no change in sensation. They were in free fall, in a world of gravity, Dutro knew, and thus unable to feel that gravity. He switched on the television again to determine their whereabouts. Earth was nowhere in sight. There was no outside air pressure, although his reckoning told him that the sphere could not have passed beyond the Earth's atmosphere in ten minutes.

"Where are we?" Giddons asked.

DUTRO looked across at her. "In deep space," he said tersely. He pointed at the screen. A wealth of stars was pinpointed against the velvet blackness of space with unwinking splendor. Switching from one to the other of the six directions, he at last located a sun.

"The Sun?" asked Giddons.

"I don't know," Dutro said. A heavy feeling bore down on his head. "It appears much too ruddy, much older in stellar evolution than Sol. We may have travelled an unbelievable distance." He frowned mightily as he scanned the heavens for one familiar sight.

"None of the constellations are familiar," he said at last. "And I would have supposed I could recognize some of them, at least, from any point within our Galaxy."

He tried one view after another of

the surrounding cosmos. "Still," he mused aloud, for Giddons' benefit, "there is the Milky Way, much as I remember it. That argues that we are still in our own Gaaxy, and I would hazzard, much where we started. Hm," he said, and fell silent.

"That last doesn't jibe with this business of no familiar constellations, does it?" he asked Giddons, trying to grin. He could feel it was a weak attempt.

Dutro was no astronomer, but his logical powers were great enough to locate four planets that seemed to fill the places of Venus, Earth, Mars and Jupiter fairly well. No planet could he locate in the former orbit of Mercury. He wondered whether the red cast of the sun he observed was due to malfunctioning of the television, and cast the thought aside when he recalled the blue-white brilliance of the distant stars. He returned to a view of the Milky Way.

"Notice," he said to his silent companion, "the Milky Way seems tilted at a sharp angle to the plane of the ecliptic, assuming that this is our own solar system. That's not right."

That's not right! Of course not. It was the other way around. *The plane of the ecliptic was tilted at a sharp angle to the central plane of the Galaxy.* He said that out loud to Giddons, and his instant perception was that such a tilting required an almost unthinkable period of time. Thousands, no, millions of years. He sat transfixed trying to determine the order of magnitude of the time that had elapsed. Billions of years, he decided.

He had been silent many minutes. Giddons was regarding him with transparent concern.

"Giddons," he said. "I must think. For a long time. I am conscious and well. Pardon my silence." He looked briefly at her, and noticing faint marks of concern, went on in a more kindly tone. "I am sorry. We are in no immediate danger; we are in some sort

of an orbit about the sun we have observed, and our distance from it leads me to believe it is elliptical."

She accepted his apology with a lowering of her eyelids, and continued to sit quietly beside him at her controls, regarding his furrowed features. The implications of his discovery of the enormous lapse of time kept Dutro occupied for the better part of an hour.

"Yes, Giddons," he said at last, and his voice was heavy with defeat. "In the final analysis, Bowditch was right on every count."

HE TURNED in his padded seat to look sorrowfully at her. "He told me the Brain did not think; it computed. It answered my questions truly, but it could not tell me the implications of the answers. Its ability to extend the powers of the human mind was limited by the ability of that mind to frame a significant question."

His smile became more wan. "And now I know what Bowditch meant by my pride, and that for it I must fall. Giddons, my realization of the flaws in the process of human mentation—which I sought to correct in the Brain—never extended to an honest admission of the flaws of my own. Whether because I thought I could create a machine that could think without a flaw, or for some other reason, I have all along felt myself above other men. For that baseless pride, Giddons, you and I have been cut off from all mankind. It is a rather fitting end." He sighed heavily, his long, dark face lined with mingled emotions of defeat and remorse.

"From what I can tell from the surface of the Sun, Giddons," he went on more briskly. ("For there is no doubt in my mind that it is Old Sol, nearly ten billion years elapsed since we left Earth.") The Sun is in its dying stages, rapidly coming to the end of its carbon-nitrogen cycle. By this time it has probably gone through

a half-dozen dying surges. I would suppose the Solar System to be a sterile, devoid of life except our own. Certainly when Mercury fell into the Sun, the disturbance must have killed all life on the inner planets." He stopped and held his palms out to her.

"It is wrong that you had to pay this price, too," he said gently.

Giddons straightened in her chair.



"If what you say is true, about the passage of time," she said, "I admit we are in trouble. But how do you explain it?"

Dutro laughed a little. "That is the most foolish part of the whole business," he said. "The machine could have told us this, if I had asked it to. But I was semantically blocked; I foolishly identified 'time in a gravitational field' with 'time outside a gravitational field'. It appears they are not the same. In effect, we have accomplished time travel, I never had a name for the gravity equations before, but I have now. They were the Achronic Equations; they eliminated 'Time'. If gravity is a manifestation of mass in a four-dimensional space-time continuum, the nullification of gravity in the presence of mass must occur only by the nullification of 'time'."

GIDDONS considered his remarks for many minutes. "I believe you are right," she said at last. "But why, if we nullified time, could we come back at all?"

Dutro's jaw dropped with surprise. He looked at her long and earnestly, his astonishment giving way to a kind of awe. "You, at least, have no semantic blocks," he told her. "The negative judgement; the critical discrimination. You are right; we did not completely

nullify gravity, in spite of our effort to do so—else we would be at the end of 'time'. The healthy number of stars in the Galaxy tells us differently." He fell silent, looking at her with an intensity he had never shown before.

"Giddons," he said. "Bowditch told me my pride would have to be abased. I sit before you now more humble than in any moment of my life. Can you understand why?"

She shook her head slowly. "No, I cannot," she replied.

Dutro smiled as he unfastened part of his harness. "You have in you, Giddons, powers that can never be within me. You, and you alone, represent the chance to evade death. You are the repository of all life. Without you, death is sure. Without me, you could, in all likelihood, sustain life." His smile had broadened.

"You follow me?" he asked.

"No."

"Giddons, how old are you?" Dutro demanded.

"Thirty-seven," she said.

"You are fertile?"

"I presume so; at least I'm in good health. Why?"

Dutro beamed at her. "The process of creation, whether of humans or of Suns, is repetitive. Our Sun is reaching its old age. It will soon collapse in on itself, when its hydrogen has been completely converted to helium, and burst forth with an enormous amount of dying energy. It will be a nova. In cooling, it will form new planets, for the present ones will be volatilized. It will cool again comparatively quickly, but there should be a period of hundreds of millions of years when temperatures will be right to support life on some of its planets.

"Giddons, without me, and by processes that I suppose you are familiar with in theory at least, you can have children, but only daughters. With me, you can have sons as well. Giddons, I am making an honorable proposal of

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Equations For Destiny

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marriage to you. And I speak not so much for myself, but rather in all humbleness for the chances of a million generations of men yet unborn."

She had the goodness to blush; Dutro was pleased.

"I accept," she said promptly, giving him her hand with a warmth he had not known was in her. "Nothing has ever been closer to my heart. But you must know that our food cannot last more than a few days."

Dutro nodded happily. "In ten min-

utes you and I travelled ten billion years. Surely, in the next hour or so, by short intervals of 'time travel', at varying rates according to how completely we nullify gravity with our generators, we can find the proper time in future history. Our descendants shall populate a whole solar system, and when the time comes to leave a finally-dwindling Sun, move through 'time' to conquer the Galaxy."

He reached for the switch.

