

LET'S HEAR IT FOR THE FUTURE!

Tired of stories with downbeat endings and plots that didn't have much point anyway? Tired of science fiction without science? Tired of the muttering mavens of mewling misery telling you that there's no way out but learning to love the life of an Indian peasant?

You want to hear about how the near future can be just fine, and the far future transcendent? Then this is the anthology for you. It's





JAMES BAEN



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GALAXY: THE BEST OF MY YEARS

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DEDICATION:

to Jerry Pournelle. For many reasons, especially friendship.

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Introduction:

This volume is an attempt to condense from the four-plus years I spent with that magazine my version of the perfect issue of Galaxy. So while I most certainly do not class myself as a writer with the other contributors to this issue (Issue? Yes, let it stand), in this quest for the paradigm, my editorial presence becomes a sine qua non. Furthermore, this editorial does define the direction Galaxy was to move under my direction: a constant, confident avowal that with (and only with) the aid of technology can we and will we make this world a nice place to live. (Not that anyone with a sense of adventure will want to live here; all the interesting things will be happening off-planet.)

Also, I was rather proud of this piece because, as far as I know, it was the first to explicitly note how much cozier is Einstein's version of the universe than Newton's. Relativistically speaking, twenty years at one gwill get you to the center of the galaxy; Newton says that at one g (16 feet per sec/sec, or one light year per year/year) twenty years barely gets you out of the neighborhood.

THE MYTH OF THE LIGHT-BARRIER

by James Baen

THE 1970's has been a decade in which every physical and spiritual boundary has drawn progressively inward until finally hope itself seems threatened with extinction. This, more than any other reason, is why, while occupying this chair, I have consistently sought out and tried to promulgate the overlooked positive factor, the factor that implies that maybe we have a chance after all—that maybe the deck is not inherently rigged against us. That maybe, just maybe, we have a destiny worth having.

To this end I now offer the thought that the speed of light as limiting velocity is not a "barrier" that will keep the stars forever from our grasp, but is instead the guarantor of future freedom—from persecution or benevolent interference—for those who will someday seek their fortunes beyond the confines of the Solar System.

Consider. At relativistic velocities time "slows down" as compared to the Universe at large. (Most sf-oriented persons are at least vaguely aware of the implications of Relativity Theory—for those who are not, I heartily recommend TAUZERO, by Poul Anderson, as an entertaining and indeed inspiring way of rectifying this omission.) What most people—even sf people—seem not to be aware of is how much time slows down. At one gravity acceleration it would take about twenty years to reach the center of the Milky Way.

Note that I do not say it would seem to take twenty

years, but that it would take twenty years. Of course the Universe will have aged 100,000 years or so, but that's another matter. A paradox? If so, a relativistic one; the single most fundamental tenet of Einstein's theory is that all frames of reference are equally valid—including the ship-board one.

And that's the point. Given a one-gravity, constant-acceleration space-vehicle plus a complete indifference to point of origin, you can go anywhere and do anything. You can even be free. Because anybody who might have an inclination to tamper with your liberty (unless you were foolish enough to bring him along) will have been dust long before you arrive at your destination. Freedom!

Introduction:

If you think science fiction has downbeat tendencies now, think back to the mid-70s: you could cut the gloom with a knife. So it was with great trepidation that I approached Dr. Asimov with the question: "Is there hope for the future, and if so will you write a five thousand word essay on the subject for me?" His reply boiled down to "No, but I'll write you the article anyway." Now that's what I call a nice guy. Funny thing is, he proceeded to write so pursuasively that I suspect he half-way pursuaded himself. At least his prognostications since then have grown progressively more optimistic . . .

IS THERE HOPE FOR THE FUTURE?

by Isaac Asimov

AT ANY TIME and under any conditions it is possible to consider the future either pessimistically or optimistically.

It is, after all, never possible to predict the future sharply; one can only make an estimate, and that estimate will cover a range of possibilities. The farther into the future we look, the broader the range. And if we look far enough the range becomes so broad that our predictions have no constraint worth mentioning other than the laws of nature. The range will also be broader as we deal with more and more poorly understood phenomena (with human pyschology, for instance, rather than with atomic physics) until it becomes too broad to make prediction useful.

If, however, we restrict ourselves to the moderately close future and to moderately well-understood phenomena, we end up with a range of possibilities that is not prohibitively broad. We are then at liberty to suppose ourselves anywhere within the range, and it is possible to end up with a pessimistic prediction if we choose to use one extreme of the range and with an optimistic one if we choose to use the other.

IT IS, for instance, particularly easy to be pessimistic about the future right now. We need merely assume that population will continue going up, that national rivalries will continue to place the well-being of Group X ahead of the welfare of the world, that racist and sexist prejudice will continue to generate hatred and alienation, that personal and ecomonic greed will continue to ruin the Earth for short-term private profit. In short we need merely assume that things will go on exactly as they have been for another thirty years and we can confidently predict the end of our technological civilization.

I suspect that the chances are better than 50 percent that this will happen—how much better I am not certain.

But things don't have to go on as they are. Things do change, and surprisingly rapidly, too.
Place yourself in 1954, for instance. It is the

Place yourself in 1954, for instance. It is the height of the complacent Eisenhower era; the depths of the Dulles cold-war. The United States was then at its most self-confident and sanctimonious point in history.

Would you have then imagined that—over the next two decades—contraception would become socially acceptable, a birth control pill would lead to sexual revolution, abortion would become legal in many places, 'cold war' would become a dirty word—and that the very man who had, in earlier years, specialized in flag, mom, and applepie rhetoric would, as President, lead the way to closer friendship with the Soviet Union and with what he now calls the People's Republic of China?!

I tell you that in 1954 it was a lot easier to predict—and to have it believed—that men would stand on the Moon in fifteen years than that any of the situations listed in the previous paragraph would come to pass.

Why did all those things come true? No mystery at all. The steady increase in population and the steady decline in resources has faced mankind with a

choice of 1) destruction, or 2) population control and world government.

The changes that have taken place in the last twenty years have been in the direction of population control and world government and were more or less inevitable if one had been willing to look the future in the face.

The changes so far have been comparatively small and tentative and are far from sufficient to prevent disaster. I think it is safe to suppose, however, that mankind will continue to move in the direction of population control and world government as, each year, the scope of disaster—and the speed with which it approaches—impresses mankind with a greater and greater horror.

The question is not whether or not mankind will move in this direction—it will!—but whether it will move in this direction rapidly enough. Again, my own feeling is that the probability of rapid-enough motion is less than 50 percent; how much less, I am not certain.

But the motion may be fast enough to avert the final catastrophe. In this respect the energy crisis of the winter of 1973-74 performed a great service. The crisis was, to a great extent, made inevitable by the folly of American foreign policy since World War II (see my article "The Double-Ended Candle" in the June 1974 issue of The Magazine of Fantasy and Science Fiction) [see also, Dr. A's great new post-Catastrophe novelette in the June issue of Worlds of If! ed.] was exacerbated by the greed of oil companies, but underlying everything is the fact that there is only a limited amount of oil in Earth's oil wells and that that limited amount is vanishing with frightening rapidity.

Nothing has done as much as the energy crisis to

convince Americans that the economic interdependence of the world is real and that it includes the United States. Nothing has done as much to convince Americans that our standard of living, so much higher than that of the rest of the world, is at the mercy of the rest of the world. In short, nothing has done as much to convince Americans of the vulnerability of the United States. That goes a long way toward making world government seem less of a dirty phrase, since it is now obvious that we may have as much to gain from a globally-organized economy as to give to it.

To be sure, at the time I write, the Arab nations have lifted their boycott and Americans are doing their best to convince themselves that, after a three-month nightmare, everything is exactly as it once was—but that's a self-delusion that cannot be maintained. Oil prices have gone up, inflation has moved along faster, and the oil in the ground is still disappearing. The crisis, believe me, is still with us and won't go away; and a certain amount of American innocence will never return.

LET US IMAGINE, then, that the Earth continues to move in the direction of population control and world government and does so quickly enough to avert a major catastrophe, suffering at most only a mild catastrophe. (After a recent talk I gave at the University of Pittsburgh, I was asked what I meant by "a mild catastrophe", and I replied, "One from which civilization can recover.")

This supposition of fast-enough movement may be low-probability but perhaps it is not zeroprobability. Perhaps, under the lash of the gathering horror, we will be forced, kicking and screaming, into survival. In that case, here would be the situation as Earth enters the 21st Century:

1) World population will stand at 7,000,000,000, but all over the world, heroic and successful measures will be holding the line, and every effort will be made to lower the birth rate to the point where the population will decline toward an ultimate goal of perhaps no more than 1,000,000,000.

2) There will be dreadful shortages of food and raw materials generally, but heroic and successful measures toward the proper distribution of what exists and toward efficient methods of re-cycling will minimize the more disastrous effects of the shortages.

3) There will still be political units of the type with which we are familiar, but few decisions of any importance will be reached except at international conferences. It will furthermore be clear that no nation can afford to take unilateral action against the will of the others.

IF ALL THIS IS SO, we can work out as inevitable corollaries (or inevitable, at least, as long as mankind chooses not to choose destruction) a number of utopian consequences. For instance—

1. The end of sexism.

Womankind's subjection has been the natural consequence of her role as baby machine. In a world of high infant mortality and low life expectancy, the need was for many babies. It takes many babies to have even a few survive, and in agricultural economies many children mean many hands to help with the work. Children are also needed to help support aged parents in a society that would otherwise let them die. (That is the significance of the

Biblical "Honor thy mother and thy father." It doesn't refer to standing up when they come into the room. It means *supporting* them.)

In the 21st Century, with a very low birthrate, with childlessness common, and with those children which are born very much more the responsibility of society in general than they are now, women's role as baby machine will have largely disappeared.

In that case, what else will women have to do? Do you suppose they can still be relegated to social and economic inferiority; made to accept the situation that household tasks are peculiarly for the female sex; that passivity is the female role in sex—in business—in government; that the highest function of woman is to support her man in a self-effacing manner and that she must place her physiological wares (but *never* her intellectual wares) constantly on view to catch him in the first place and reflect favorably on him in the second?

If this were indeed to be the situation, women would be condemned to lives so empty that child-bearing and child-rearing would be all that could fill them. There would then be an enormous tendency to strive for children under any conditions.

To keep the birthrate successfully low women must be beguiled into other activities; what method would be so natural and so effective as to declare them people—and to allow them to enter all facets of human endeavor on an equal basis with men?

2. The end of racism.

Racism has existed as long as mankind, because any slight difference marks one as outside-the-tribe and therefore as someone to be mocked—if mockery is safe—or feared, if it is not safe to mock. Introduce a new child into a group of children and have him wear clothes a trifle different in style, or speak in a slightly different accent, and watch him become marked for scapegoating at once.

It does not matter that the clothes may differ in being cleaner, or the accent in being more precise, the result is the same. The key word is not 'better', nor is it 'worse'; it is merely 'different.' And, of course, in the thought-processes of the bigot, 'different', whatever its nature, becomes 'worse.'

That is why I am not impressed by the attempts of men like Shockley to argue that Blacks are less intelligent than Whites; that it is the natural inferiority of Blacks that has caused them to be discriminated against, and (by obvious implication) that it is for that reason that they should continue to be discriminated against.

In the first place, I don't accept Shockley's arguments on intelligence. I do not believe that intelligence can as yet be measured, or even *defined*, with sufficient precision as to make it possible to divide humanity into large groups of greater or lesser intelligence, with the difference just happening to coincide with something as irrelevant to intelligence as skin color.

Nevertheless, if intelligence could be defined and measured, and if it turned out that Blacks were inferior to Whites in intelligence, that would still be totally irrelevant to the matter of the continued mistreatment of Blacks. It is the difference in appearance that triggers the bigotry and it would be no less if Blacks were more intelligent than Whites.

As a matter of fact, I know of minority groups which, in the stereotypical minds of bigots, are

stigmatized as being too intelligent. They are "cunning", "shrewd", "sly" and, although in a small minority, are continually on the point of "taking over the country"—if they have not indeed already done so. And how does Shockley explain that?

—But observe how matters will change in the 21st Century; not out of the increase of goodness and love in the human heart (alas!) but out of the pressing

necessity for survival.

If population is to be stabilized and even forced into a period of slow and humane reduction, it can only be accomplished by convincing humanity that this reduction is not an excuse to wipe out some groups and perpetuate others. Birth control can easily be used for this purpose, or be suspected of being used for this purpose.

In order for population control to work at all, and for mankind to avoid catastrophe, then, all people (or at the very least, enough people) must be convinced that all groups will be respected equally. While open bigotry exists, how can people be convinced of this? Mankind will simply have to school itself to assume a virtue if it has it not, and pretend to love neighbors and fellow-men even when it does not. And if the assumption is made long enough and the pretense is kept up steadily enough, the fact that it is merely assumption and pretense may eventually be forgotten.

Of course, you might imagine that we needn't persuade inferior people to cut down on their children. Why don't we just wipe out all those high-breeding, low-standard people and control the population even more efficiently? That might sound nice to you if you're sure that nobody with a plane and a bomb is going around considering you inferior,

but let's suppose you are on the right side of the gun.

It would still not be the right side, for the policy of wiping out the unworthy would not be merely a matter of powerful countries wiping out weak ones. Within every country, if bigotry rules, there are racial and economic groups that would seem, to bigots, to be breeding too fast and best controlled by death. The confusion and chaos that the rule of death would then bring about would surely dissolve our all-too-rickety technological structure, bringing it down upon our heads—even if we happen to be the ones holding all the guns.

No! If the 21st Century is to work at all, it will have to work without racism.

There will be factors that should make this easier than we now think possible. If technological civilization survives into the 21st Century it is quite obvious that computerization and automation of society will continue to advance. Such advance will militate against racism.

Increasingly, we will be developing a society in which unskilled and semi-skilled manual and mental labor will be done by machines and there won't be the economic pressure to maintain a large supply of people under conditions of oppression and of carefully-inculcated acceptance of inferiority in order that these people might be content to perform these unskilled and semi-skilled tasks at low pay.

(Naturally, the disappearance of such work will make it all the more sensible to reduce the population, since it will take fewer people to run the world.)

Then, too, advances in communication—the use of satellites bound to each other and to Earth's surface by laser beams capable of carrying millions of

communication channels—will knit the entire globe into a small community. ("Global village" is the term most frequently used.) While efficient communication is no guarantee of brotherly-love, it does make it a little easier to get along with someone you dislike if you can at least talk to him.

The fact that in the 21st Century it will be far easier for all people to have access to education and to the general store of information amassed by the species will wipe out some of the more obvious and fallacious "intellectual" differences.

In a global village there will also be an increasing push toward a common language. I don't mean necessarily an *exclusive* common language, with all the rich differences in language and culture that now bless our planet wiped out. Let each group have their own language and ways, but let each group also know some language with which they can reach all other groups.

(I personally favor English as the common language, because of its great vocabulary and because of its already unparalleled widespread use—and also because I am a linguistic-chauvinist pig.)

The smallness of the world, the ease of communication, the equalizing of opportunity, the common language—all will act to depress the sense of difference and will therefore tend to defuse the push toward bigotry.

Even the mere fact of a decreasing population in a century of continuing scientific advance, will make bigotry increasingly unpopular. The gradual increase in the understanding of genetics will make it clear that, from the standpoint of species survival, the greatest asset we can have is genetic diversity.

There are species that are so perfectly adapted to a

particular environment that they survive virtually unchanged for millions and millions of years. Such perfect adaptation achieves relative genetic uniformity and makes those species sharply limited in range and at the total mercy of the environment. Let the favored environment disappear and the species lacks the genetic equipment to survive.

The genetic diversity of a generalized species makes it possible for that species to adapt this way or that and to survive in one form or another long after the living fossils have met their doom.

As the human population declines, then, there will be considerable concern lest too many genes vanish. People generally will then hail diversity and be glad that other people exist who are different from themselves in appearance and abilities as living proof that the human gene pool is still healthily broad

3. The end of war.

Actually, we have already reached the end of war, as long as national leaders are guided in their decisions by sanity. (That they will be so guided is not a foregone conclusion, of course.)

A nuclear war between the United States and the Soviet Union is clearly mutual suicide as far as the two nations are concerned. What's more, it would probably destroy our technological civilization generally and, through the radiation it produced, would seriously compromise the viability of the planet as a whole.

This almost everybody recognizes, so the question is whether a non-nuclear war is really possible, and the answer is "No!" The trouble is that the

advance of technology has made war into such a high-energy game, played with such highsophistication pieces, that no one can afford to play anymore.

Under the best conditions, war is fought with a nation's surplus energy and resources. Or a nation can fight a *short* war even without surplus energy and resources in the hope of seizing an enemy's energy and resources and continuing the fight with those. Where *no* nation has surplus energy and resources large enough to support the current technology of war, the whole process becomes purposeless and a mere exercise in suicide, albeit one somewhat slower than the nuclear variety.

The most recent war which managed to last for years and which reached a clear-cut decision without too badly damaging the victors was, of course, World War II. Since World War II (thirty years now!) there have been two wars that involved at least one great power directly and that lasted for years—the Korean War and the Vietnam War.

Both of these wars ended exactly where they began. The United States had to end each war by dealing with an enemy whose territorial extent, military strength, and political nature had not been changed by the American effort. All we could claim was that the other side hadn't actually won. In each case we could have wiped out the enemy if we had exerted our maximum strength, but in each case we did not dare.

All other wars fought on Earth since 1945 have been small-scale, or very short, or both. And in no case could one of them have progressed at all without the support given to one side or another by one of the great powers.

Right now, it takes all the United States can spare to support a military force under *peacetime* conditions, and no other nation is any better off. And as energy supplies and material resources decrease, it will become more and more difficult to afford all those uniforms and all that gold-braid.

In the 21st Century, the nations of the world will be forced into international cooperation as the only way of tackling and defeating the problems besetting them, and armies will be expensive anachronisms—except, perhaps, as organized labor forces.

So war will vanish not because of a growth of goodness in the human heart, or understanding in the human mind (would that that were so!) but only because war has *already* priced itself out of existence, except as a form of world suicide.

4. The extension of the life-span.

If our technological civilization survives into the 21st Century that will mean that medical science has continued to advance.

Increasingly, degenerative and metabolic diseases will be successfully treated. Arthritis, cancer, ciculatory disorders may all join the various infectious diseases as merely minor dangers.

This means that more and more people will reach the age of 70 before dying (already in such places as Scandinavia half the men and slightly more than half the women do so.) The 21st Century population will then consist of a greater percentage of old people than now exists in the population and (thanks to birth control) a considerably smaller percentage of young people.

Gerontology—the medical study of the phe-

nomena of old age—will therefore become the most important medical specialty, both because of a plethora of cases and a fall-off in the importance of other specialties.

Until today, all that medical advance has done is to make it possible for more men and women to grow old. This is not to be sneered at, of course, and I am personally delighted with even such limited progress since it won't be long till I'll be passing out of late youth and into very early middle age myself.

Still, once a person reaches 70, he or she is old—as old today as he or she would have been if he or she had performed the much more difficult task of running the gauntlet of disease and misery, to reach the age of 70 in Homer's time.

Old age is sometimes said to be just one more disease, but if so, it is a disease different from all others, since it alone seems to be inevitable and inescapable. There is logical reason to suppose that old age is built into the genes. Cells from human embryonic tissue, even when given an idyllic, protected environment and supplied with ample nourishment, divide more and more slowly as time goes on, and after some fifty divisions—divide no more.

The cells run down; their divisions eventually stop; they die and are not replaced; and the whole intricate machinery of the body falters, then grinds to a halt. The running down may be through the accumulation of errors as genes replicate time after time; or through the slow accumulation of waste products; or through the slow deterioration of protein molecules.

Whatever it is, it seems to be programmed in the start. And we can see why this should be so.

After all, each new child is born with a brand-new gene combination to be tested for its survival value. Each new child is a new throw of the evolutionary dice, a new turn of the wheel. In order to assure the necessary sorting and re-sorting of the new, so that the species can be always adjusted to better fit an old environment or to come to fit a new one, the old must be taken off the stage. The existence of death by old age, which makes certain this removal even when all other causes of death fail, encourages and speeds evolution. It hastens and strengthens the development of the species at the cost of the individual.

But whatever the cause of old age and however programmed that cause might be, could it not be reversed, as biologists learn more and more about the intimate details of cellular biophysics and biochemistry, and learn also how to manipulate those details?

Might not old age be prevented for a time, or reversed to a degree, and might not people live for two centuries rather than one and remain young through most of the doubled life-span? Might they not live longer still? Might they not be potentially immortal—or at least have the option of living until they voluntarily choose to die?

Perhaps! It may be that the 21st Century, while it sees the population decreasing steadily, will also see the individual life-span increasing steadily (and therefore making necessary a still further drop in the birth-rate.)

But in that case will not the extended life-span and the ever slower addition of new babies to the species slow human evolution and endanger human survival in the long run? Yet who is to say that evolution must proceed only by that mechanism which has, in fact, been used through all the billions of years of life on Earth? So far, evolution has been carried on by random gene-combinations-and-recommendations; by rangene-mutations-and-new-combinations—and by an endless epidemic of random death to make sure of an endless turnover of generations with their new gene-combinations.

Now, after three billion years, we have on Earth a species which is, for the first time, potentially capable of directing its own evolution.

Perhaps the 21st Century will see the beginning of something new under the sun; something radically different—a species more stable than any other that has ever existed; one with individuals that endure far longer and remain far less affected by the passing of the years; one that accumulates wisdom and experience in each individual to an enormous extent; and one that guides its own evolutionary destiny across the very slow heart-beat of generations through thoughtful genetic engineering rather than by random death.

5. The expansion of man's range.

If we imagine the triumph of genetic engineering, we can, if we choose to adopt the pessimistic view, picture mankind as consisting of a limited number of very old, very tired individuals, who for centuries have not had a new thought. You might see mankind turning from physiological death merely to find a new and infinitely more horrible intellectual death.

Even if we discount genetic engineering and immortality, and suppose that death will always hold

its sway over mankind, we might still picture the 21st Century as the century-of-the-middle-aged, since there are bound to be more old people and fewer young people. Might not the generally older population be stodgier, more conservative, more unoriginal, more uninnovative than we are today?

We might even argue that in the 21st Century mankind will have learned the lesson of the 20th Century (or civilization will not have survived). In the 21st Century, people will know that indiscriminate growth is no longer possible. They will know that they cannot consume and pollute at will. They will know that everything will have to be recycled as far as possible and that every new advance, every change, will have to be closely examined for side-effects.

Conservatism will, of necessity, be built into 21st Century society and that great and heroic dash into the unknown will be forever gone. What will be left will be the life of the sloth which, hanging suspended, moves each limb slowly forward and tests the branch carefully before gradually shifting its weight.

This is what we must look forward to. Or is it?

We can, of course, argue the point. Are old people really stodgier and more conservative than young? In societies in which the proper attention is paid to the old, and which are not as youth-worshipping as our own is today, might it not turn out that the old are as innovative as the young?

Suppose, though, we don't argue the point. Suppose that we are threatened with an innate conservatism and the death of daring. Is there any way it can be fought?

What we need is a horizon to be passed, a limit to

be penetrated. Of course, there will always be horizons and limits in the intellectual world—and the great battle against the unknown will never be over. But this is an ethereal battle and one which may not catch the imagination of humanity as a species.

What we need is something physical and visible—and surely that we have. When the last horizon on Earth has contracted to zero and the last limit has vanished, there remains an unimaginably vast Universe beyond the Earth.

In the 21st Century, space exploration and space colonization will become not merely a matter of scientific curiosity but will be something necessary to keep alive that vital spark of daring in mankind. And in adopting an exercise to insure the survival of the spirit of humanity we will also gain in other important ways.

On the Moon, a colony could take advantage of the Moon's environment; its airlessness, its extremes of temperature, its hard radiation, to gain knowledge and to develop industrial finesse that would be difficult or impossible to accomplish on Earth.

In addition, a Lunar colony, to survive, would have to do so in an environment even more restrictive than that of Earth, and thus could serve as an example to be followed. The Moon could easily be the school of Earth.

Then, too, it may be only by way of a Moon colony that mankind can explore the rest of the Universe.

The Moon is easy to reach—it is only three days away even by the primitive space technology of today. To reach any sizeable body of the Solar system beyond the Moon will, however, take anywhere from months to decades; and to reach even the

nearer stars will take from decades to centuries. To imagine Earthmen forsaking Earth for years of lifetimes in a constricted spaceship is to imagine too much, perhaps.

To be sure, the Earth is itself a spaceship, but an atypical one. It is the kind of spaceship in which the life-support system and the crew cling to the outside of the hull, having grown so used to this that life within the hull is difficult to adjust to.

On the other hand, a Moon colony can only exist in caverns beneath the surface; that would be in a typical spaceship environment. For a group of Moon colonists to get into a spaceship and venture farther out into space for years at a time would be far easier, psychologically, than for Earthmen to do so. To the Moon-colonists, the spaceship would be much more nearly like home.

And if the time comes when large ships are built that are capable of supporting an ecologically-independent human society over the generations (as in Heinlein's "Universe") then surely it will not be Earthmen but the Moon colonists—or their descendants, the people of the hollowed-out asteroids—who will serve as the crew.

In fact, we might imagine the asteroids themselves, after having been inhabited for a greater or lesser time, turned into spaceships, driven out of their orbits by some advanced space-drive, and launched beyond the Solar system and into the depths of space. In that case, there would be no psychological difficulty worth mentioning. The crew would be staying at home.

So however stodgy Earth may get (and I insist that it may *not* get stodgy) there will always be the escape-valve of space exploration and the 21st Cen-

tury may witness the beginning of the expansion of mankind's range—an expansion without limit.

People from Earth may sometimes qualify to emigrate to the Moon; people from the Moon may sometimes qualify to emigrate to one or another of the asteroids; people from the asteroids may sometimes choose to launch themselves into interstellar space.

The net result will be that the Galaxy, and, indeed, all the galaxies, will be opened, in the long run, to human beings and to their descendants (proliferating into many para-human species). Out in space, humanity in all its varieties may meet and mingle with non-human intelligences, so that we will no longer be alone.

What's more, if tachyons do exist and if we can bend them to our will—or in some other way get around the speed-of-light limit—we may even end with the kind of Galactic Empire dreamed of by myself (if mankind is the only intelligent species in the Galaxy) or by E. E. Smith (if it is not).

LET'S summarize, then. The immediate future looks dark. Civilization may not survive the crisis that is upon us.

If, however, we can shift quickly enough in the direction of population control and world-government and can hang on for thirty years, the long-range future—within the later lifetime of the young people alive today—can be made incredibly bright.

We will then have a 21st Century that will be the dream of an older generation of science fiction writers (writing prior to the current fashion of darkness and doom) come true. Imagine a world, in which the

scourge of war is eliminated and the horrors of sexism and racism wiped out, in which lives are expanded and enriched, and in which all of space is opened to us.

If only we can get through this crisis-

Introduction:

Before it was written, "The Day Before the Revolution" was to have been first published in a mainstream anthology, Bitches and Sad Ladies. Virginia Kidd, Ms. Le Guin's agent, is a very canny lady, however; after reading it, she decided it was one of those stories that had to be seen by the core sf audience. Turns out she was right.

Since another editor had rejected it on the ground that "it wasn't really science fiction," it came to me accompanied by an introductory essay in which Ms. Le Guin gently explained why the presence of technological elements is not a necessary criterion of science fiction. By me the idea that "The Day Before . . ." was not sf was . . . bemusing, and so I elected to publish it sans justification. Turns out I was right, too: far from needing to prove its right to exist, the story won both the Nebula and the Hugo that year. (I had hoped to be able to append that introduction as an afterward, but it's been mislaid.)

THE DAY BEFORE THE REVOLUTION

by Ursula K. Le Guin

THE SPEAKER'S VOICE was loud as empty beer-trucks in a stone street, and the people at the meeting were jammed up close, cobble-stones, that great voice booming over them. Taviri was somewhere on the other side of the hall. She had to get to him. She wormed and pushed her way among the darkclothed, close-packed people. She did not hear the words, nor see the faces: only the booming, and the bodies pressed one behind the other. She could not see Taviri, she was too short. A broad black-vested belly and chest loomed up blocking her way. She must get through to Taviri. Sweating, she jabbed fiercely with her fist. It was like hitting stones, he did not move at all, but the huge lungs let out right over her head a prodigious noise, a bellow. She cowered. Then she understood that the bellow had not been at her. Others were shouting. The speaker had said something, something fine about taxes or shadows. Thrilled, she joined the shouting—"Yes! Yes!"-and shoving on, came out easily into the open expanse of the Regimental Drill Field in Parheo. Overhead the evening sky lay deep and colorless, and all around her nodded the tall weeds with dry, white, close-floreted heads. She had never known what they were called. The flowers nodded above her head, swaying in the wind that always blew across the fields in the dusk. She ran among them, and they whipped lithe aside and stood up again swaying, silent. Taviri stood among the tall weeds in his good suit, the dark grey one that made him look like a professor or a play-actor, harshly elegant. He did not look happy, but he was laughing, and saying something to her. The sound of his voice made her cry, and she reached out to catch hold of his hand, but she did not stop, quite. She could not stop. "Oh, Taviri," she said, "it's just on there!" The queer sweet smell of the white weeds was heavy as she went on. There were thorns, tangles underfoot, there were slopes, pits. She feared to fall . . . she stopped.

SUN, bright morning-glare, straight in the eyes, relentless. She had forgotten to pull the blind last night. She turned her back on the sun, but the right side wasn't comfortable. No use. Day. She sighed twice, sat up, got her legs over the edge of the bed, and sat hunched in her nightdress looking down at her feet.

The toes, compressed by a life-time of cheap shoes, were almost square where they touched each other, and bulged out above in corns; the nails were discolored and shapeless. Between the knob-like ankle bones ran fine, dry wrinkles. The brief little plain at the base of the toes had kept its delicacy, but the skin was the color of mud, and knotted veins crossed the instep. Disgusting. Sad, depressing. Mean. Pitiful. She tried on all the words, and they all fit, like hideous little hats. Hideous: yes, that one too. To look at oneself and find it hideous, what a job!

But then, when she hadn't been hideous, had she sat around and stared at herself like this? Not much! A proper body's not an object, not an implement, not a belonging to be admired, it's just you, yourself. Only when it's no longer you, but yours, a thing owned, do you worry about it—Is it in good shape? Will it do? Will it last?

"Who cares?" said Laia fiercely, and stood up.

It made her giddy to stand up suddenly. She had to put out her hand to the bedtable, for she dreaded falling. At that she thought of reaching out to Taviri, in the dream.

What had he said? She could not remember. She was not sure if she had even touched his hand. She frowned, trying to force memory. It had been so long since she had dreamed about Taviri; and now not even to remember what he had said!

It was gone, it was gone. She stood there hunched in her night-dress, frowning, one hand on the bedtable. How long was it since she had thought of him—let alone dreamed of him—even thought of him, as 'Taviri'? How long since she had said his name?

Asieo said. When Asieo and I were in prison in the North. Before I met Asieo. Asieo's theory of reciprocity. Oh yes, she talked about him, talked about him too much no doubt, maundered, dragged him in. But as 'Asieo,' the last name, in the public man. The private man was gone, utterly gone. There were so few left who had even known him. They had all used to be in jail. One laughed about it in those days, all the friends in all the jails. But they weren't even there, these days. They were in the prison cemeteries. Or in the common graves.

"Oh, oh my dear," Laia said out loud, and she

sank down onto the bed again because she could not stand up under the remembrance of those first weeks in the Fort, in the cell, those first weeks of the nine years in the Fort in Drio, in the cell, those first weeks after they told her that Asieo had been killed in the fighting in Capitol Square and had been buried with the Fourteen Hundred in the limeditches behind Oring Gate. In the cell. Her hands fell into the old position on her lap, the left clenched and locked inside the grip of the right, the right thumb working back and forth a little pressing and rubbing on the knuckle of the left first finger. Hours, days, nights. She had thought of them all, each one, each one of the fourteen hundred, how they lay, how the guicklime worked on the flesh, how the bones touched in the burning dark. Who touched him? How did the slender bones of the hand lie now? Hours, years.

"Taviri, I have never forgotten you!" she whispered, and the stupidity of it brought her back to morning-light and the rumpled bed. Of course she hadn't forgotten him. These things go without saying between husband and wife. There were her ugly old feet flat on the floor again, just as before. She had got nowhere at all, she had gone in a circle. She stood up with a grunt of effort and disapproval, and went to the closet for her dressing gown.

The young people went about the halls of the House in becoming immodesty, but she was too old for that. She didn't want to spoil some young man's breakfast with the sight of her. Besides, they had grown up in the principle of freedom of dress and sex and all the rest, and she hadn't. All she had done was invent it. It's not the same.

Like speaking of Asieo as 'my husband.' They

winced. The word she should use as a good Odonian, of course, was 'partner.' But why the hell did she have to be a good Odonian?

She shuffled down the hall to the bathrooms. Mairo was there, washing her hair in a lavatory. Laia looked at the long, sleek, wet hank with admiration. She got out of the House so seldom now that she didn't know when she had last seen a respectably shaven scalp, but still the sight of a full head of hair gave her pleasure, vigorous pleasure. How many times had she been jeered at, Longhair, Longhair, had her hair pulled by policemen or young toughs, had her hair shaved off down to the scalp by a grinning soldier at each new prison? And then had grown it all over again, through the fuzz, to the frizz, to the curls, to the mane . . . In the old days. For God's love, couldn't she think of anything today but the old days?

Dressed, her bed made, she went down to commons. It was a good breakfast, but she had never got her appetite back since the damned stroke. She drank two cups of herb tea, but couldn't finish the piece of fruit she had taken. How she had craved fruit as a child, badly enough to steal it; and in the Fort-oh for God's love stop it! She smiled and replied to the greetings and friendly inquiries of the other breakfasters and big Aevi who was serving the counter this morning. It was he who had tempted her with the peach, "Look at this, I've been saving it for you." and how could she refuse? Anyway she had always loved fruit, and never got enough; once when she was six or seven she had stolen a piece off a vendor's cart in River Street. But it was hard to eat when everyone was talking so excitedly. There was news from Thu, real news. She was inclined to discount it at first, being wary of enthusiasms, but after she had read the article in the paper, and read between the lines of it, she thought, with a strange kind of certainty, deep but cold, Why, this is it; it has come. And in Thu, not here. Thu will break before this country does; the Revolution will first prevail there. As if that mattered! There will be no more nations. And vet it did matter somehow, it made her a little cold and sad-envious, in fact. Of all the infinite stupidities. She did not join the talk much, and soon got up to go back to her room, feeling sorry for herself. She could not share their excitement. She was out of it, really out of it. It's not easy, she said to herself in justification, laboriously climbing the stairs, to accept being out of it when you've been in it, in the center of it, for fifty years. Oh for God's love. Whining!

She got the stairs and the self-pity behind her, entering her room. It was a good room, and it was good to be by herself. It was a great relief. Even if it wasn't strictly fair. Some of the kids in the attics were living five to a room no bigger than this. There were always more people wanting to live in an Odonian House than could be properly accommodated. She had this big room all to herself only because she was an old woman who had had a stroke. And maybe because she was Odo. If she hadn't been Odo, but merely the old woman with a stroke, would she have had it? Very likely. After all who the hell wanted to room with a drooling old woman? But it was hard to be sure. Favoritism, elitism, leader-worship, they crept back and cropped out everywhere. But she had never hoped to see them eradicated in her lifetime, in one generation; only Time works the great changes. Meanwhile this was a nice, large,

sunny room, proper for a drooling old woman who had started a world revolution.

Her secretary would be coming in an hour to help her dispatch the day's work. She shuffled over to the desk, a beautiful, big piece, a present from the Nio Cabinetmakers' Syndicate because somebody had heard her remark once that the only piece of furniture she had ever really longed for was a desk with drawers and enough room on top . . . damn, the top was practically covered with papers with notes clipped to them, mostly in Noi's small clear handwriting: Urgent.—Northern Provinces.—Consult w/R.T.?

Her own handwriting had never been the same since Asieo's death. It was odd, when you thought about it. After all, within five years after his death she had written the whole Analogy. And there were those letters, which the tall guard with the watery grey eyes, what was his name, never mind, had smuggled out of the Fort for her for two years. The Prison Letters they called them now, there were a dozen different editions of them. All that stuff, the letters which people kept telling her were so full of "spiritual strength"—which probably meant she had been lying herself blue in the face when she wrote them, trying to keep her spirits up—and the Analogy which was certainly the solidest intellectual work she had ever done, all of that had been written in the Fort in Drio, in the cell, after Asieo's death. One had to do something, and in the Fort they let one have paper and pens . . . But it had all been written in the hasty, scribbling hand which she had never felt was hers, not her own like the round, black scrollings of the manuscript of Society Without Government, forty-five years old. Taviri had taken

not only her body's and her heart's desire to the quicklime with him, but even her good clear handwriting.

BUT HE HAD LEFT her the revolution.

How brave of you to go on, to work, to write, in prison, after such a defeat for the Movement, after your partner's death, people had used to say. Damn fools. What else had there been to do? Bravery, courage—what was courage? She had never figured it out. Not fearing, some said. Fearing yet going on, others said. But what could one do but go on? Had one any real choice, ever?

To die was merely to go on in another direction.

If you wanted to come home you had to keep going on, that was what she meant when she wrote, 'True journey is return," but it had never been more than an intuition, and she was farther than ever now from being able to rationalise it. She bent down, too suddenly, so that she grunted a little at the creak in her bones, and began to root in a bottom drawer of the desk. Her hand came to an agesoftened folder and drew it out, recognizing it by touch before sight confirmed: the manuscript of Syndical Organization in Revolutionary Transition. He had printed the title on the folder and written his name under it, Taviri Odo Asieo, IX 741. There was an elegant handwriting, every letter well-formed, bold, and fluent. But he had preferred to use a voiceprinter. The manuscript was all in voiceprint, and high quality too, hesitancies adjusted and idiosyncrasies of speech normalized. You couldn't see there how he had said 'o' deep in his throat as they did on the North Coast. There was nothing of him there but his mind. She had nothing of him at all

except his name written on the folder. She hadn't kept his letters, it was sentimental to keep letters. Besides, she never kept anything. She couldn't think of anything that she had ever owned for more than a few years, except this ramshackle old body, of course, and she was stuck with that . . .

Dualizing again. "She" and "it." Age and illness made one dualist, made one escapist; the mind insisted, It's not me, it's not me. But it was. Maybe the mystics could detach mind from body, she had always rather wistfully envied them the chance, without hope of emulating them. Escape had never been her game. She had sought for freedom here, now, body and soul.

First self-pity, then self-praise, and here she still sat, for God's love, holding Asieo's name in her hand, why? Didn't she know his name without looking it up? What was wrong with her? She raised the folder to her lips and kissed the handwritten name firmly and squarely, replaced the folder in the back of the bottom drawer, shut the drawer, and straightened up in the chair. Her right hand tingled. She scratched it, and then shook it in the air, spitefully. It had never quite got over the stroke. Neither had her right leg, or right eye, or the right corner of her mouth. They were sluggish, inept, they tingled. They made her feel like a robot with a short circuit.

And time was getting on, Noi would be coming, what had she been doing ever since breakfast?

She got up so hastily that she lurched, and grabbed at the chair-back to make sure she did not fall. She went down the hall to the bathroom and looked in the big mirror there. Her grey knot was loose and droopy, she hadn't done it up well before breakfast. She struggled with it a while. It was hard

to keep her arms up in the air. Amai, running in to piss, stopped and said, "Let me do it!" and knotted it up tight and neat in no time, with her round, strong, pretty fingers, smiling and silent. Amai was twenty, less than a third of Laia's age. Her parents had both been members of the Movement, one killed in the insurrection of '60, the other still recruiting in the South Provinces. Amai had grown up in Odonian Houses, born to the Revolution, a true daughter of anarchy. And so quiet and free and beautiful a child, enough to make you cry when you thought: this is what we worked for, this is what we meant, this is it, here she is, alive, the kindly, lovely future.

Laia Osaieo Odo's right eye wept several little tears, as she stood between the lavatories and the latrines having her hair done up by the daughter she had not borne; but her left eye, the strong one, did not weep, nor did it know what the right eye did.

She thanked Amai and hurried back to her room. She had noticed, in the mirror, a stain on her collar. Peach juice, probably. Damned old dribbler. She didn't want Noi to come in and find her with drool on her collar.

As the clean shirt went on over her head, she thought, What's so special about Noi?

She fastened the collar-frogs with her left hand,

slowly.

Noi was thirty or so, a slight, muscular fellow with a soft voice and alert dark eyes. That's what was special about Noi. It was that simple. Good old sex. She had never been drawn to a fair man or a fat one, or the tall fellows with big biceps, never, not even when she was fourteen and fell in love with every passing fart. Dark, spare, and fiery, that was the recipe. Taviri, of course. This boy wasn't a patch on

Taviri for brains, nor even for looks, but there it was: She didn't want him to see her with dribble on her collar and her hair coming undone.

Her thin, grey hair.

Noi came in, just pausing in the open door-way—my God, she hadn't even shut the door while changing her shirt!—She looked at him and saw herself. The old woman.

You could brush your hair and change your shirt, or you could wear last week's shirt and last night's braids, or you could put on cloth of gold and dust your shaven scalp with diamond powder. None of it would make the slightest difference. The old woman would look a little less, or a little more, grotesque.

One keeps oneself neat out of mere decency, mere sanity, awareness of other people.

And finally even that goes, and one dribbles unashamed.

"Good morning," the young man said in his gentle voice.

"Hello, Noi."

No, by God, it was not out of mere decency. Decency be damned. Because the man she had loved, and to whom her age would not have mattered—because he was dead, must she pretend she had no sex? Must she suppress the truth, like a damned puritan authoritarian? Even six months ago, before the stroke, she had made men look at her and like to look at her; and now, though she could give no pleasure, by God she could please herself.

When she was six years old, and Papa's friend Gadeo used to come by to talk politics with Papa after dinner, she would put on the gold-colored necklace that Mama had found on a trash-heap and brought home for her. It was so short that it always

got hidden under her collar where nobody could see it. She liked it that way. She knew she had it on. She sat on the doorstep and listened to them talk, and knew that she looked nice for Gadeo. He was dark, with white teeth that flashed. Sometimes he called her "pretty Laia." "There's my pretty Laia!" Sixtysix years ago.

"What? My head's dull. I had a terrible night." It

was true. She had slept even less than usual.

"I was asking if you'd seen the papers this morning."

She nodded.

"Pleased about Soinehe?"

Soinehe was the province in Thu which had declared its secession from the Thuvian State last night.

He was pleased about it. His white teeth flashed in his dark, alert face. Pretty Laia.

"Yes. And apprehensive."

"I know. But it's the real thing, this time. It's the beginning of the end of the Government in Thu. They haven't even tried to order troops into Soinehe, you know. It would merely provoke the soldiers into rebellion sooner, and they know it."

She agreed with him. She herself had felt that certainty. But she could not share his delight. After a lifetime of living on hope because there is nothing but hope, one loses the taste for victory. A real sense of triumph must be preceded by real despair. She had unlearned despair a long time ago. There were no more triumphs. One went on.

"Shall we do those letters today?"

"All right. Which letters?"

"To the people in the North," he said without impatience.

"In the North?"

"Parheo, Oaidun."

She had been born in Parheo, the dirty city on the dirty river. She had not come here to the capital till she was twenty-two and ready to bring the Revolution. Though in those days, before she and the others had thought it through, it had been a very green and puerile revolution. Strikes for better wages, representation for women. Votes and wages—Power and Money, for the love of God! Well, one does learn a little, after all, in fifty years.

But then one must forget it all.

"Start with Oaidun," she said, sitting down in the armchair. Noi was at the desk ready to work. He read out excerpts from the letters she was to answer. She tried to pay attention, and succeeded well enough that she dictated one whole letter and started on another. "Remember that at this stage your brotherhood is vulnerable to the threat of . . . no, to the danger . . . to" She groped till Noi suggested, "The danger of leader-worship?"

"All right. And that nothing is so soon corrupted by power-seeking as altruism. No. And that nothing corrupts altruism—no. Oh, for God's love you know what I'm trying to say, Noi, you write it. They know it too, it's just the same old stuff, why can't they read

my books!"

"Touch," Noi said gently, smiling, citing one of the central Odonian themes.

"All right, but I'm tired of being touched. If you'll write the letter I'll sign it, but I can't be bothered with it this morning." He was looking at her with a little question of concern. She said, irritable, "There is something else I have to do!"

WHEN NOI HAD GONE she sat down at the desk and moved the papers about, pretending to be doing

something, because she had been startled, frightened, by the words she had said. She had nothing else to do. She never had had anything else to do. This was her work: her lifework. The speaking tours and the meetings and the streets were out of reach for her now, but she could still write, and that was her work. And anyhow if she had had anything else to do, Noi would have known it; he kept her schedule, and tactfully reminded her of things, like the visit from the foreign students this afternoon.

Oh, damn. She liked the young, and there was always something to learn from a foreigner, but she was tired of new faces, and tired of being on view. She learned from them, but they didn't learn from her; they had learnt all she had to teach long ago, from her books, from the Movement. They just came to look, as if she were the Great Tower in Rodarred, or the Canyon of the Tulaevea. A phenomenon, a monument. They were awed, adoring. She snarled at them: Think your own thoughts!—That's not anarchism, that's mere obscurantism.—You don't think liberty and discipline are incompatible, do you?-They accepted their tonguelashing meekly as children, gratefully, as if she were some kind of All-Mother, the idol of the Big Sheltering Womb. She! She who had minded the shipyards at Seissero, and had cursed Premier Inoilte to his face in front of a crowd of seven thousand, telling him he would have cut off his own balls and had them bronzed and sold as souvenirs, if he thought there was any profit in it-she who had screeched, and sworn, and kicked policemen, and spat at priests, and pissed in public on the big brass plaque in Capitol Square that said HERE WAS FOUNDED THE SOVEREIGN NATION STATE OF

A-10 ETC ETC, pssssssss to all that! And now she was everybody's grand-mama, the dear old lady, the sweet old monument, come worship at the womb. The fire's out, boys, it's safe to come up close.

"No, I won't," Laia said out loud. "I will not." She was not self-conscious about talking to herself, because she always had talked to herself. "Laia's invisible audience," Taviri had used to say, as she went through the room muttering. "You needn't come, I won't be here," she told the invisible audience now. She had just decided what it was she had to do. She had to go out. To go into the streets.

It was inconsiderate to disappoint the foreign students. It was erratic, typically senile. It was un-Odonian. Pssssss to all that. What was the good working for freedom all your life and ending up without any freedom at all? She would go out for a walk.

"What is an anarchist? One who, choosing, accepts the responsibility of choice."

On the way downstairs she decided, scowling, to stay and see the foreign students. But then she would go out.

They were very young students, very earnest: doe-eyed, shaggy, charming creatures from the Western Hemisphere, Benbili and the Kingdom of Mand, the girls in white trousers, the boys in long kilts, warlike and archaic. They spoke of their hopes. "We in Mand are so very far from the Revolution that maybe we are near it," said one of the girls, wistful and smiling: "The Circle of Life!" and she showed the extremes meeting, in the circle of her slender, dark-skinned fingers. Amai and Aevi served them white wine and brown bread, the hospitality of the House. But the visitors, unpresump-

tuous, all rose to take their leave after barely half an hour. "No, no, no," Laia said, "stay here, talk with Aevi and Amai. It's just that I get stiff sitting down, you see, I have to change about. It has been so good to meet you, will you come back to see me, my little brothers and sisters, soon?" For her heart went out to them, and theirs to her, and she exchanged kisses all round, laughing, delighted by the dark young cheeks, the affectionate eyes, the scented hair, before she shuffled off. She was really a little tired, but to go up and take a nap would be a defeat. She had wanted to go out. She would go out. She had not been alone outdoors since—when? since winter! before the stroke. No wonder she was getting morbid. It had been a regular jail sentence. Outside, the streets, that's where she lived.

She went quietly out the side door of the House, past the vegetable patch, to the street. The narrow strip of sour city dirt had been beautifully gardened and was producing a fine crop of beans and ceea, but Laia's eye for farming was unenlightened. Of course it had been clear that anarchist communities, even in the time of transition, must work towards optimal self-support, but how that was to be managed in the way of actual dirt and plants wasn't her business. There were farmers and agronomists for that. Her job was the streets, the noisy, stinking streets of stone, where she had grown up and lived all her life, except for the fifteen years in prison.

She looked up fondly at the facade of the House. That it had been built as a bank gave peculiar satisfaction to its present occupants. They kept their sacks of meal in the bombproof money-vault, and aged their cider in kegs in safe deposit boxes. Over the fussy columns that faced the street, carved let-

ters still read, "NATIONAL INVESTORS AND GRAIN FACTORS BANKING ASSOCIATION." The Movement was not strong on names. They had no flag. Slogans came and went as the need did. There was always the Circle of Life to scratch on walls and pavements where Authority would have to see it. But when it came to names they were indifferent, accepting and ignoring whatever they got called, afraid of being pinned down and penned in, unafraid of being absurd. So this best known and second oldest of all the cooperative Houses had no name except The Bank.

It faced on a wide and quiet street, but only a block away began the Temeba, an open market, once famous as a center for black market psychogenics and teratogenics, now reduced to vegetables, secondhand clothes, and miserable sideshows. Its crapulous vitality was gone, leaving only half-paralysed alcoholics, addicts, cripples, hucksters, and fifth-rate whores, pawnshops, gambling dens, fortune-tellers, body sculptors, and cheap hotels. Laia turned to the Temeba as water seeks its level.

She had never feared or despised the city. It was her country. There would not be slums like this, if the Revolution prevailed. But there would be misery. There would always be misery, waste, cruelty. She had never pretended to be changing the human condition, to be Mama taking tragedy away from the children so they won't hurt themselves. Anything but. So long as people were free to choose, if they chose to drink flybane and live in sewers, it was their business. Just so long as it wasn't the business of Business, the source of profit and the means of power for other people. She had felt all that before she knew anything; before she wrote the first pam-

phlet, before she left Parheo, before she knew what 'capital' meant, before she'd been farther than River Street where she played rolltaggie kneeling on scabby knees on the pavement with the other six-year-olds. She had known it: that she, and the other kids, and her parents, and their parents, and the drunks and whores and all of River Street, were at the bottom of something—were the foundation, the reality, the source.

But will you drag civilisation down into the mud? cried the shocked decent people, later on, and she had tried for years to explain to them that if all you had was mud, then if you were God you made it into human beings, and if you were human you tried to make it into houses where human beings could live. But nobody who thought he was better than mud would understand. Now, water seeking its level, mud to mud, Laia shuffled through the foul, noisy street, and all the ugly weakness of her old age was at home. The sleepy whores, their lacquered hairarrangements dilapidated and askew, the one-eyed woman wearily yelling her vegetables to sell, the halfwit beggar slapping flies, these were her countrywomen. They looked like her, they were all sad, disgusting, mean, pitiful, hideous. They were her sisters, her own people.

She did not feel very well. It had been a long time since she had walked so far, four or five blocks, by herself, in the noise and push and stinking summer heat of the streets. She had wanted to get to Koly Park, the triangle of scruffy grass at the end of the Temeba, and sit there for a while with the other old men and women who always sat there, to see what it was like to sit there and be old; but it was too far. If she didn't turn back now, she might get a dizzy spell,

and she had a dread of falling down, falling down and having to lie there and look up at the people come to stare at the old woman in a fit. She turned and started home, frowning with effort and self-disgust. She could feel her face very red, and a swimming feeling came and went in her ears. It got a bit much, she was really afraid she might keel over. She saw a doorstep in the shade and made for it, let herself down cautiously, sat, sighed.

Nearby was a fruit-seller, sitting silent behind his dusty, withered stock. People went by. Nobody bought from him. Nobody looked at her. Odo, who was Odo? Famous revolutionary, author of *Community*, *The Analogy*, etc. etc. She, who was she? An old woman with grey hair and a red face sitting on a dirty doorstep in a slum, muttering to herself.

True? Was that she? Certainly it was what anybody passing her saw. But was it she, herself, any more than the famous revolutionary, etc., was? No. It was not. But who was she, then?

The one who loved Taviri.

Yes. True enough. But not enough. That was gone; he had been dead so long.

"Who am I?" Laia muttered to her invisible audience, and they knew the answer and told it to her with one voice. She was the little girl with scabby knees, sitting on the doorstep staring down through the dirty golden haze of River Street in the heat of late summer, the six-year-old, the sixteen-year-old, the fierce, cross, dream-ridden girl, untouched, untouchable. She was herself. Indeed she had been the tireless worker and thinker, but a bloodclot in a vein had taken that woman away from her. Indeed she had been the lover, the swimmer in the midst of life, but Taviri, dying, had taken that woman away with

him. There was nothing left, really, but the foundations. She had come home; she had never left home. "True voyage is return." Dust and mud and a doorstep in the slums. And beyond, at the far end of the street, the field full of tall dry weeds blowing in the wind as night came.

"Laia! What are you doing here? Are you all

right?"

One of the people from the House, of course, a nice woman, a bit fanatical and always talking. Laia could not remember her name though she had known her for years. She let herself be taken home, the woman talking all the way. In the big cool common-room (once occupied by tellers counting money behind polished counters supervised by armed guards) Laia sat down in a chair. She was unable just as yet to face climbing the stairs, though she would have liked to be alone. The woman kept on talking, and other excited people came in. It appeared that a demonstration was being planned. Events in Thu were moving so fast that the mood here had caught fire, and something must be done. Day after tomorrow, no, tomorrow, there was to be a march, a big one, from Old Town to Capitol Square—the old route. "Another Ninth Month Uprising," said a young man, fiery and laughing, glancing at Laia. He had not even been born at the time of the Ninth Month Uprising, it was all history to him. Now he wanted to make some history of his own. The room had filled up. A general meeting would be held here, tomorrow, at eight in the morning. "You must talk, Laia."

"Tomorrow? Oh, I won't be here tomorrow," she said brusquely. Whoever had asked her smiled, another one laughed, though Amai glanced round at

her with a puzzled look. They went on talking and shouting. The Revolution. What on earth had made her say that? What a thing to say on the eve of the Revolution, even if it was true.

She waited her time, managed to get up and, for all her clumsiness, to slip away unnoticed among the people busy with their planning and excitement. She got to the hall, to the stairs, and began to climb them one by one. "The general strike," a voice, two voices, ten voices were saying in the room below, behind her. "The general strike," Laia muttered, resting for a moment on the landing. Above, ahead, in her room, what awaited her? The private strike. That was mildly funny. She started up the second flight of stairs, one by one, one leg at a time, like a small child. She was dizzy, but she was no longer afraid to fall. On ahead, on there, the dry white flowers nodded and whispered in the open fields of evening. Seventy-two years and she had never had time to learn what they were called.

Introduction:

As well as being one of the most intelligent and well-read of men, Poul Anderson is one of the most modest. I lusted for a monthly dose of his unique combination of poetic vision and data-based speculation. Try as I might, I could not convince him to come on board as a regular columnist. Not convincing him ("But Jim," he would say, "there are so many others so much more qualified.") I regarded as one of my major editorial failures.

OUR MANY ROADS TO THE STARS

by Poul Anderson

THERE ARE COUNTLESS varieties of science fiction these days, and I would be the last to want any of them restricted in any way. Nevertheless, what first drew me to this literature and, after more years than I like to add up, still holds me, is its dealing with the marvels of the universe. To look aloft at the stars on a clear night and think that someday, somehow we might actually get out among them, rouses the thrill anew, and I become young again. After all, we made it to the Moon didn't we? Meanwhile, only science fiction of the old and truly kind takes the imagination forth on that journey. Therefore I put up with its frequent flaws; and so does many another dreamer.

But are we mere dreamers, telling ourselves stories of voyages yonder as our ancestors told of voyages to Avalon and Cíbola? Those never existed, and the stars do; but, realistically, does any possibility of reaching them?

The case against interstellar travel traditionally begins with the sheer distances. While Pioneer 10 and 11, the Jupiter flybys, will leave the Solar System, they won't get as far as Alpha Centauri, the nearest neighbor sun, for more than 40,000 years. (They aren't actually bound in that direction.) At five times their speed, or 100 miles per second, which we are nowhere close to reaching today, the trip would take longer than recorded history goes back. And the average separation of stars in this galactic vicinity is twice as great.

If we could go very much faster—

At almost the speed of light, we'd reach Alpha Centauri in about four and a third years. But as most of you know, we who were faring would experience a shorter journey. Both the theory of relativity and experimental physics show that time passes "faster" for a fast-moving object. The closer to the speed of light, the greater the difference, until at that velocity itself, a spaceman would make the trip in no time at all. However, the girl he left behind him would measure his transit as taking the same number of years as a light ray does; and he'd take equally long in coming back to her.

In reality, the velocity of light in vacuo, usually symbolized by c, cannot be attained by any material body. From a physical viewpoint, the reason lies in Einstein's famous equation $E=mc^2$. Mass and energy are equivalent. The faster a body moves, the more energy it has, and hence the more mass. This rises steeply as velocity gets close to c, and at that speed would become infinite, an obvious impossibility.

Mass increases by the same factor as time (and length) shrink. An appendix to this essay defines the terms more precisely than here. A table there gives some representative values of the factor for different values of velocity, v, compared to c. At $v=0.7\,c$, that is, at a speed of 70% light's, time aboard ship equals distance covered in light-years. Thus, a journey of 10 light-years at $0.7\,c$ would occupy 10 years of the crew's lives, although to people on Earth or on the target planet, it would take about 14.

There's a catch here. We have quietly been supposing that the whole voyage is made at exactly this rate. In practice, the ship would have to get up to speed first, and brake as it neared the goal. Both these maneuvers take time; and most of this time is spent at low velocities where the relativistic effects aren't noticeable.

Let's imagine that we accelerate at one gravity, increasing our speed by 32 feet per second each second and thus providing ourselves with a comfortable Earth-normal weight inboard. It will take us approximately a year (a shade less) to come near c, during which period we will have covered almost half a lightyear, and during most of which period our time rate won't be significantly different from that of the outside cosmos. In fact, not until the eleventh month would the factor get as los as 0.5, though from then on it would start a really steepening nosedive. Similar considerations apply at journey's end, while we slow down. Therefore a trip under these conditions would never take less than two years as far as we are concerned: if the distance covered is 10 light-years, the time required is 11 years as far as the girl (or boy) friend left behind is concerned.

At the "equalizing" v of 0.7 c, these figures become 10.7 years for the crew and 14.4 years for the stay-at-homes. This illustrates the dramatic gains that the former, if not the latter, can make by pushing c quite closely. But let's stay with that value of 0.7 c for the time being, since it happens to be the one chosen by Bernard Oliver for his argument against the feasibility of star travel.

Now Dr. Oliver, vice president for research and development at Hewlett-Packard, is definitely not unimaginative, nor hostile to the idea as such. Rather, he is intensely interested in contacting extraterrestrial intelligence, and was the guiding genius of Project Cyclops, which explored the

means of doing so by radio. The design which his group came up with could, if built, detect anybody who's using radio energy like us today within 100 light-years. Or it could receive beacon signals of reasonable strength within 1000 light-years: a sphere which encloses a million suns akin to Sol and half a billion which are different.

Still, he does not fudge the facts. Making the most favorable assumption, a matter-antimatter annihilation system which expels radiation itself, he has calculated the minimum requirement for a round trip with a stopover at the destination star, at a peak speed of 0.7c. Assuming 1000 tons of ship plus payload, which is certainly modest, he found that it must convert some 33,000 tons of fuel into energy-sufficient to supply the United States, at present levels of use, for half a million years. On first starting off from orbit, the ship would spend 10 times the power that the Sun gives to our entire Earth. Shielding requirements alone, against stray gamma rays, make this an absurdity, not to speak of a thousand square miles of radiating surface to cool the vessel if as little as one one-millionth of the energy reaches it in the form of waste heat.

Though we can reduce these figures a good deal if we assume it can refuel at the other end for its return home, the scheme looks impractical regardless. Moreover, Dr. Oliver, no doubt deliberately, has not mentioned that space is not empty. Between local stars, it contains about one hydrogen atom per cubic centimeter, plus smaller amounts of other materials. This is a harder vacuum than any we can achieve artificially. But a vessel ramming through it at $0.7\,c$ would release X-radiation at the rate of some 50 million roentgen units per hour. It takes less than

1000 to kill a human being. No material shielding could protect the crew for long, if at all.

Not every scientist is this pessimistic about the rocket to the stars, that is, a craft which carries its own energy source and reaction mass. Some hope for smaller, unmanned probes, perhaps moving at considerably lower speeds. But given the mass required for their life support and equipment, men who went by such a vehicle would have to reckon on voyages lasting generations or centuries.

This is not impossible, of course. Maybe they could pass the time in suspended animation. Naturally radioactive atoms in the body set an upper limit to that, since they destroy tissue which would then not be replaced. But Carl Sagan, astronomer and exobiologist at Cornell University, estimates that a spore can survive up to a million years. This suggests to me that humans should be good for anyway several thousand.

Or maybe, in a huge ship with a complete ecology, an expedition could beget and raise children to carry their mission on. Calculations by Gerald K. O'Neill, professor of physics at Harvard, strongly indicate that this is quite feasible. His work has actually dealt with the possibility of establishing permanent, self-sustaining colonies in orbit, pleasanter to live in than most of Earth and capable of producing more worldlets like themselves from extraterrestrial resources. He concludes that we can start on it now, with existing technology and at startlingly low cost, and have the first operational by the late 1980's. Not long afterward, somebody could put a motor on one of these.

The hardened science fiction reader may think such ideas are old hat. And so they are, in fiction.

But to me the fact is infinitely more exciting than any story—that the accomplishment can actually be made, that sober studies by reputable professionals are confirming the dream.

True, I'd prefer to believe that men and women can get out there faster, more easily, so that the people who sent them off will still be alive when word arrives of what they have discovered. Is this wishful thinking? We've written off the rocket as a means of ultra-fast travel, but may there be other ways?

Yes, probably there are. Even within the framework of conventional physics, where you can never surpass c, we already have more than one well-reasoned proposal. If not yet as detailed and mathematical as Oberth's keystone work on interplanetary travel of 1929, the best of them seem equivalent to Tsiolkovsky's cornerstone work of 1911. If the time scale is the same for future as for past developments, then the first manned Alpha Centauri expedition should leave about the year 2010. . . .

That's counting from R. W. Bussard's original paper on the interstellar ramjet, which appeared in 1960. Chances are that a flat historical parallel is silly. But the engineering ideas positively are not. They make a great deal of sense.

Since the ramjet has been in a fair number of stories already, I'll describe the principle rather briefly. We've seen that at high speeds, a vessel must somehow protect its crew from the atoms and ions in space. Lead or other material shielding is out of the question. Hopelessly too much would be required, it would give off secondary radiation of its own, and ablation would wear it down, incidentally

producing a lot of heat, less readily dissipated in space than in an atmosphere. Since the gas must be controlled anyway, why not put it to work?

Once the ship has reached a speed which turns out to be reasonable for a thermonuclear rocket—and we're on the verge of that technology today—a scoop can collect the interstellar gas and funnel it into a reaction chamber. There, chosen parts can be fusion-burned for energy to throw the rest out backward, thus propelling the vessel forward. Ramjet aircraft use the same principle, except that they must supply fuel to combine with the oxygen they collect. The ramjet starcraft takes everything it needs from its surroundings. Living off the country, it faces none of the mass-ration problems of a rocket, and might be able to crowd c very closely.

Needless to say, even at the present stage of pure theory, things aren't that simple. For openers, how large an apparatus do we need? For a ship-plus-payload mass of 1000 tons, accelerating at one gravity and using proton-proton fusion for power, Bussard and Sagan have both calculated a scoop radius of 2000 kilometers. Now we have no idea as yet how to make that particular reaction go. We are near the point of fusing deuterons, or deuterons and tritons (hydrogen nuclei with one and two neutrons respectively), to get a net energy release. But these isotopes are far less common than ordinary hydrogen, and thus would require correspondingly larger intakes. Obviously, we can't use collectors made of metal.

But then, we need nonmaterial shielding anyway. Electromagnetic fields exert force on charged particles. A steady laser barrage emitted by the ship can ionize all neutral atoms within a safety zone, and so make them controllable, as well as vaporizing rare bits of dust and gravel which would otherwise be a hazard. (I suspect, myself, that this won't be necessary. Neutral atoms have electrical asymmetries which offer a possible grip to the forcefields of a more advanced technology than ours. I also feel sure we will master the proton-proton reaction, and eventually matter-antimatter annihilation. But for now, let's play close to our vests.) A force-field scoop, which being massless can be of enormous size, will catch these ions, funnel them down paths which are well clear of the crew section and into a fusion chamber, cause the chosen nuclei to burn, and expel everything aft to drive the vessel forward, faster and faster.

To generate such fields, A. J. Fennelly of Yeshiva University and G. L. Matloff of the Polytechnic Institute of New York propose a copper cylinder coated with a super-conducting layer of niobium-tin alloy. The size is not excessive, 400 meters in length and 200 in diameter. As for braking, they suggest a drogue made of boron, for its high melting point, ten kilometers across. This would necessarily work rather slowly. But then, these authors are cautious in their assumptions; for instance, they derive a peak velocity of just 0.12 c. The system could reach Alpha Centauri in about 53 years, Tau Ceti in 115.

Centauri in about 53 years, Tau Ceti in 115.

By adding wings, however, they approximately halve these travel times. The wings are two great superconducting batteries, each a kilometer square. Cutting the lines of the galactic magnetic field, they generate voltages which can be tapped for exhaust acceleration, for magnetic bottle containers for the power reaction, and for inboard electricity. With thrust shut off, they act as auxiliary brakes, much

shortening the deceleration period. When power is drawn at different rates on either side, they provide maneuverability—majestically slow, but sufficient—almost as if they were huge oars.

All in all, it appears that a vessel of this general type can bring explorers to the nearest stars while they are still young enough to carry out the exploration—and the preliminary colonization?—themselves. Civilization at home will start receiving a flood of beamed information, fascinating, no doubt often revolutionary in unforeseeable ways, within a few years of their arrival. Given only a slight lengthening of human life expectancy, they might well spend a generation out yonder and get home alive, still hale. Certainly their children can.

Robert L. Forward, a leading physicist at Hughes Research Laboratories, has also interested himself in the use of the galactic magnetic field. As he points out, the ion density in interstellar space is so low that a probe could easily maintain a substantial voltage across itself. Properly adjusted, the interaction forces produced by this will allow mid-course corrections and terminal maneuvers at small extra energy cost. Thus we could investigate more than one star with a single probe, and eventually bring it home again.

Indeed, the price of research in deep space is rather small. Even the cost of manned vessels is estimated by several careful thinkers as no more than ten billion dollars each—starting with today's technology. That's about 50 dollars per American, much less than we spend every year on cigarettes and booze, enormously less than goes for wars, bureaucrats, subsidies to inefficient businesses, or the servicing of the national debt. For mankind as a

whole, a starship would run about \$2.50 per head. The benefits it would return in the way of knowledge, and thus of improved capability, are immeasurably great.

But to continue with those manned craft. Mention of using interstellar magnetism for maneuvering raises the thought of using it for propulsion. That is, by employing electromagnetic forces which interact with that field, a ship could ideally accelerate itself without having to expel any mass backward. This would represent a huge saving over what the rocket demands.

The trouble is, the galactic field is very weak, and no doubt very variable from region to region. Though it can be valuable in ways that we have seen, there appears to be no hope of using it for a powerful drive.

Might we invent other devices? For instance, if we could somehow establish a negative gravity force, this might let our ship react against the mass of the universe as a whole, and thus need no jets. Unfortunately, nobody today knows how to do any such thing, and most physicists take for granted it's impossible. Not all agree: because antigravity-type forces do occur in relativity theory, under special conditions.

Physics does offer one way of reaching extremely high speeds free, the Einsteinian catapult. Later I shall have more to say about the weird things that happen when large, ultra-dense masses spin very fast. But among these is their generation of a force different from Newtonian gravity, which has a mighty accelerating effect of its own. Two neutron stars, orbiting nearly in contact, could kick almost to light velocity a ship which approached them on the right orbit.

Alas, no such pair seems to exist anywhere near the Solar System. Besides, we'd presumably want something similar in the neighborhood of our destination, with exactly the characteristics necessary to slow us down. The technique looks rather implausible. What is likely, though, is that closer study of phenomena like these may give us clues to the method of constructing a field drive.

Yet do we really need it? Won't the Bussard ramjet serve? Since it picks up everything it requires as it goes, why can't it keep on accelerating indefinitely, until it comes as close to c as the captain desires? The Fennelly-Matloff vehicle is not intended to do this. But why can't a more advanced model?

Quite possibly it can!

Before taking us off on such a voyage, maybe I'd better answer a question or two. If the ship, accelerating at one gravity, is near c in a year, and if c is the ultimate speed which nature allows, how can the ship keep on accelerating just as hard, for just as long as the flight plan says?

The reason lies in the relativistic contraction of space and time, when these are measured by a fast-moving observer. Suppose we, at rest with respect to the stars, track a vesse for 10 light-years at its steady speed of $0.9\,c$. To us, the passage takes 11 years. To the crew, it takes 4.4 years: because the distance crossed is proportionately less. They never experience faster-than-light travel either. What they do experience, when they turn their instruments outward, is a cosmos strangely flattened in the direction of their motion, where the stars (and their unseen friends at home) age strangely fast.

The nearer they come to c, the more rapidly these effects increase. Thus as they speed up, they perceive themselves as accelerating at a steady rate

through a constantly shrinking universe. Observers on a planet would perceive them as accelerating at an ever lower rate through an unchanged universe. At last, perhaps, millions of light-years might be traversed and millions of years pass by outside while a man inboard draws a breath.

By the way, those authors are wrong who have described the phenomenon in terms of "subjective" versus "objective" time. One set of measurements is as valid as another.

The "twin paradox" does not arise. This old chestnut says, "Look, suppose we're twins, and you stay home while I go traveling at high speed. Now I could equally well claim I'm stationary and you're in motion—therefore that you're the one flattened out and living at a slower rate, not me. So what happens when we get back together again? How can each of us be younger than his twin?"

It overlooks the fact that the traveler does come home. The situation would indeed be symmetrical if the spaceman moved forever at a fixed velocity. But then he and his brother, by definition, never would meet to compare notes. His accelerations (which include slowdowns and changes of course) take the whole problem out of special and into general relativity. Against the background of the stars, the traveler has moved in a variable fashion; forces have acted on him.

Long before time and space measurements aboard ship differ bizarrely much from those on Earth, navigational problems will arise. They are the result of two factors, aberration and Doppler effect.

Aberration is the apparent displacement of an object in the visual field of a moving observer. It results from combining his velocity with the velocity

of light. (Analogously, if we are out in the rain and, standing still, feel it falling straight down, we will feel it hitting us at a slant when we start walking. The change in angle will be larger if we run.) At the comparatively small orbital speed of Earth, sensitive instruments can detect the aberration of the stars. At speeds close to c, it will be huge. Stars will seem to crawl across the sky as we accelerate, bunching in its forward half and thinning out aft.

Doppler effect, perhaps more widely familiar, is the shift in observed wavelength from an emitting object, when the observer's velocity changes. If we move away from a star, we see its light reddened; if we move toward a star, we see its light turned more blue. Again, these changes become extremely marked as we approach c.

Eventually our relativistic astronaut sees most of the stars gathered in a ring ahead of him, though a few sparsely strewn individuals remain visible elsewhere. The ring itself, which Frederik Pohl has dubbed the "starbow," centers on a circle which is mainly dark, because nearly all light from there has been blue-shifted out of the frequencies we can see. The leading or inner edge of the ring is bluish white, its trailing or outer edge reddish; in between is a gradation of colors, akin to what we normally observe. Fred Hollander, a chemist at Brookhaven National Laboratories, has calculated the starbow's exact appearance for different v. It gets narrower and moves farther forward, the bull's eye dead ahead gets smaller and blacker, the faster we gountil, for instance, at 0.9999 c we perceive a starbow about ten degrees of arc in width, centered on a totally black circle of about the same diameter, and little or nothing shows anywhere else in the sky.

At that speed, 0.9999 c, we'd cross 100 light-years

in 20 months of our personal lifetimes. So it's worth trying for; but we'll have to figure out some means of knowing where we are! Though difficult, the problem does not look unsolvable in principle.

It may become so beyond a certain velocity. If we travel under acceleration the whole way, speeding up continuously to the half-way point, thereafter braking at the same rate until we reach our goal: then over considerable distances we get truly staggering relativity factors. The longer a voyage, the less difference it makes to us precisely how long it is.

Thus, Dr. Sagan points out that explorers faring in this wise at one gravity will reach the nearer stars within a few years, Earth time, and slightly less, crew time. But they will cross the approximately 650 light-years to Deneb in 12 or 13 years of their own lifespans; the 30,000 light-years to the center of our galaxy in 21 ship years; the two million light-years to the Andromeda galaxy in 29 ship years; or the 10 million light-years to the Virgo cluster of galaxies in 31 ship years. If they can stand higher accelerations, or have some way to counteract the drag on their bodies, they can cross these gulfs in less of their own time; the mathematical formula governing this is in the appendix.

But will the starbow become too thin and dim for navigation? Or will they encounter some other practical limit? For instance, when matter is accelerated, it radiates energy in the form of gravity waves. The larger the mass, the stronger this radiation; and of course the mass of our spaceship will be increasing by leaps and bounds and pole-vaults. Eventually it may reach a condition where it is radiating away as much energy as it can take in, and thus be unable to go any faster.

However, the real practical limit is likelier to arise from the fact that we have enough stars near home to keep us interested for millennia to come. Colonies planted on worlds around some of these can, in due course, serve as nuclei for human expansion ever further into the universe.

Because many atoms swept through its force-fields are bound to give off light, a ramjet under weigh must be an awesome spectacle. At a safe distance, probably the hull where the crew lives is too small for the naked eye. Instead, against the constellations one sees a translucent shell of multicolored glow, broad in front, tapering aft to a fiery point where the nuclear reaction is going on. (Since this must be contained by force-fields anyway, there is no obvious reason for the fusion chamber to be a metal room.) Thence the exhaust streams backward, at first invisible or nearly so, where its particles are closely controlled, but becoming brilliant further off as they begin to collide, until finally a nebula-like chaos fades away into the spatial night.

It's not only premature, it's pointless to worry about limitations. Conventional physics appears to tell us that, although nature has placed an eternal bound on the speed of our traveling, the stars can still be ours . . . if we really want them.

Yet we would like to reach them more swiftly, with less effort. Have we any realistic chance whatsoever of finding a way around the light-velocity barrier?

Until quite recently, every sensible physicist would have replied with a resounding "No." Most continue to do so. They point to a vast mass of experimental data; for instance, if subatomic particles did not precisely obey Einsteinian laws, our big

accelerators wouldn't work. The conservatives ask where there is the slightest empirical evidence for phenomena which don't fit into the basic scheme of relativity. And they maintain that, if ever we did send anything faster than light, it would violate causality.

I don't buy that last argument, myself. It seems to me that, mathematically and logically, it presupposes part of what it sets out to prove. But this gets a bit too technical for the present essay, especially since many highly intelligent persons disagree with me. Those whom I mentioned are not conservatives in the sense of having stick-in-the-mud minds. They are among the very people whose genius and imagination make science the supremely exciting, creative endeavor which it is these days.

Nevertheless we do have a minority of equally qualified pioneers who have lately been advancing new suggestions.

I suppose the best known idea comes from Gerald Feinberg, professor of physics at Columbia University. He has noted that the Einsteinian equations do not actually forbid material particles which move faster than light—if these have a mass that can be described by an imaginary number (that is, an ordinary number multiplied by the square root of minus one. Imaginary quantities are common, e.g., in the theory of electromagnetism). Such "tachyons," as he calls them, would travel faster and faster the less energy they have; it would take infinite energy to slow them down to c, which is thus a barrier for them too.

Will it forever separate us, who are composed of "tardyons," from the tachyon part of the cosmos? Perhaps—but not totally. It is meaningless to speak

of anything which we cannot, in principle, detect if it exists. If tachyons do, there must be some way by which we can find experimental evidence for them, no matter how indirect. This implies some kind of interaction (via photons?) with tardyons. But interaction, in turn, implies a possibility of modulation. That is, if they can affect us, we can affect them.

And . . . in principle, if you can modulate, you can do anything. Maybe it won't ever be feasible to use tachyons to beam a man across space; but might we, for instance, use them to communicate faster than light?

Needless to say, first we have to catch them, i.e. show that they exist. This has not yet been done, and maybe it never can be done because in fact there aren't any. Still, one dares hope. A very few suggestive data are beginning to come out of certain laboratories—

Besides, we have other places to look. Hyperspace turns out to be more than a hoary science fiction catchphrase. Geometrodynamics now allows a transit from point to point, without crossing the space between, via a warp going "outside" that space—often called a wormhole. Most wormholes are exceedingly small, of subatomic dimensions; and a trip through one is no faster than a trip through normal space. Nevertheless, the idea opens up a whole new field of research, which may yield startling discoveries.

Black holes have been much in the news, and in science fiction, these past several years. They are masses so dense, with gravity fields so strong, that light itself cannot escape. Theory has predicted for more than 40 years that all stars above a particular size must eventually collapse into the black hole

state. Today astronomers think they have located some, as in Cygnus X-1. And we see hypotheses about black holes of less than stellar mass, which we might be able to find floating in space and utilize.

For our purposes here, the most interesting trait of a black hole is its apparent violation of a whole series of conservation laws so fundamental to physics that they are well-nigh Holy Writ. Thus many an issue, not long ago considered thoroughly settled, is again up for grabs. The possibility of entering a black hole and coming out "instantly" at the far end of a space warp is being seriously discussed. Granted, astronauts probably couldn't survive a close approach to such an object. But knowledge of these space warp phenomena and their laws, if they do occur in reality, might well enable us to build machines which—because they don't employ velocity—can circumvent the c barrier.

Black holes aren't the sole things which play curious tricks on space and time. An ultra-dense toroid, spinning very rapidly in smoke ring fashion, should theoretically create what is called a Kerr metric

space warp, opening a way to hyperspace.

The most breathtaking recent development of relativity that I know of is by F. J. Tipler, a physicist at the University of Maryland. According to his calculations, not just near-instantaneous crossings of space should be possible, but time travel should be! A cylinder of ultra-dense matter, rotating extremely fast (velocity at the circumference greater than $0.5\,c$) produces a region of multiple periodic spacetime. A particle entering this can, depending on its exact track, reach any event in the universe, past or future.

The work was accepted for publication in Physical

Review, which is about as respectable as science can get. Whether it will survive criticism remains to be seen. But if nothing else, it has probably knocked the foundation out from under the causality argument against faster-than-light travel: by forcing us to rethink our whole concept of causality.

The foregoing ideas lie within the realm of accepted physics, or at least on its debatable borders. Dr. Forward has listed several others which are beyond the frontier... but only barely, and only to date. Closer study could show, in our near future, that one or more of them refer to something real.

For instance, we don't know what inertia "is." It seems to be a basic property of matter; but why? Could it be an inductive effect of gravitation, as Mach's Principle suggests? If so, could we find ways to modify it, and would we then be held back by the increase of mass with velocity?

Could we discover, or produce, negative mass? This would gravitationally repel the usual positive kind. Two equal masses, positive and negative, linked together, would make each other accelerate in a particular direction without any change in momentum or energy. Could they therefore transcend c?

A solution of Einstein's field equations in five dimensions for charged particles gives an electron velocity of a billion trillion c. What then of a spaceship, if the continuum should turn out to have five rather than four dimensions?

Conventional physics limits the speed of massenergy. But information is neither; from a physical standpoint, it represents negative entropy. So can information outrun light, perhaps without requiring any medium for its transmission? If you can send information, in principle you can send anything.

Magnificent and invaluable though the structure of relativity is, does it hold the entire truth? There are certain contradictions in its basic assumptions which have never been resolved and perhaps never can be. Or relativity could be just a special case, applying only to local conditions.

Once we are well and truly out into space, we may find the signs of a structure immensely more ample.

These speculations have taken us quite far beyond known science. But they help to show us how little known that science really is, even the parts which have long felt comfortingly, or confiningly, familiar. We can almost certainly reach the stars. Very possibly, we can reach them easily.

If we have the will.

Appendix

Readers who shudder at sight of an equation can skip this part, though they may like to see the promised table. For different velocities, it gives the values of the factors "tau" and "gamma." These are simply the inverses of each other. A little explanation of them may be in order.

Suppose we have two observers, A and B, who have constant velocities. We can consider either one as being stationary, the other as moving at velocity v. A will measure the length of a yardstick B carries, in the direction of motion, and the interval between two readings of a clock B carries, as if these quantities were multiplied by tau. For example, if v is 0.9 c, then B's yardstick is merely 0.44 times as long in A's eyes as if B were motionless; and an hour, regis-

tered on B's clock, corresponds to merely 0.44 hour on A's. On the other hand, mass is multiplied by gamma. That is, when B moves at 0.9 c, his mass according to A is 2.26 times what it was when B was motionless.

B in turn, observes himself as normal, but A and A's environs as having suffered exactly the same changes. Both observers are right.

υ	Tau	Gamma	
0.1 c	0.995	1.005	
0.5~c	0.87	1.15	
0.7~c	0.72	1.39	
$0.9 \ c$	0.44	2.26	
$0.99 \ c$	0.14	7.10	
0.9999 c	0.017	58.6	

The formula for tau is $(1 - v^2/c^2)^{1/2}$ where the exponent "½" indicates a square root. Gamma equals one divided by tau, or $(1 - v^2/c^2)^{-1/2}$.

As for relativistic acceleration, if this has a constant value a up to midpoint, then a negative (braking) value -a to destination, the time to cover a distance S equals (2c/a) arc $\cosh (1 - aS/2c^2)$. For long distances, this reduces to $(2c/a) \ln (aS/c^2)$ where "1 n" means "natural logarithm." The maximum velocity, reached at midpoint, is $c[1 - (1 + aS/2c^2)^{-2}]^{1/2}$.

Introduction:

Fred Pohl has always annoyed me; it's just not fair that one of the top two or three authors in this field should also be one of the top two or three editors. Take "The Gift of Garigolli." That it is an example of top-notch sf is patent. But it is also an example of top-notch editing. Proof: one of the authors passed away in the late fifties, yet the story is absolute state-of-the-art. Can you find the weld marks? I sure can't.

Anyway, Uncle Fred has personally promised me that he isn't going to edit anymore, and just be a writer like he's supposed to. But I don't believe him for a minute.

THE GIFT OF GARIGOLLI

by Frederik Pohl and C. M. Kornbluth

GARIGOLLI

To Home Base

Greetings, Chief,

I'm glad you're pleased with the demographics and cognitics studies. You don't mention the orbital mapping, but I suppose that's all complete and satisfactory.

Now will you please tell me how we're going

to get off this lousy planet?

Keep firmly in mind, Chief, that we're not complainers. You don't have a better crew anywhere in the Galaxy and you know it. We've complied with the Triple Directive, every time, on every planet we've explored. Remember Arcturus XII? But this time we're having trouble. After all, look at the disproportion in mass. And take a look at the reports we've sent in. These are pretty miserable sentients, Chief.

So will you let us know, please, if there has ever been an authorized exception to Directive Two? I don't mean we aren't going to bust a link to comply—if we can—but frankly, at this moment, I don't see how.

And we need to get out of here fast. Gargolli. ALTHOUGH IT WAS a pretty morning in June, with the blossoms dropping off the catalpa trees and the algae blooming in the 12-foot plastic pool, I was not enjoying either my breakfast or the morning mail.

The letter from the lawyer started, the way letters

from lawyers do, with

RE: GUDSELL VS. DUPOIR

and went on to advise Dupoir (that's me, plus my wife and our two-year-old son Butchie) that unless a certified check arrived in Undersigned's office before close of business June 11th (that was tomorrow) in the amount of \$14,752.03. Undersigned would be compelled to institute Proceedings at once.

I showed it to my wife, Shirl, for lack of anything

better to do.

She read it and nodded intelligently. "He's really been very patient with us, considering," she said. "I

suppose this is just some more lawyer-talk?"

It had occurred to me, for a wild moment, that maybe she had \$14,752.03 in the old sugar bowl as a surprise for me, but I could see she didn't. I shook my head. "This means they take the house," I said. "I'm not mad any more. But you won't sign anything for your brother after this, will you?"

"Certainly not," she said, shocked. "Shall I put that letter in the paper-recycling bin?"

"Not just yet," I said, taking off my glasses and

hearing aid. Shirl knows perfectly well that I can't hear her when my glasses are off, but she kept on talking anyway as she wiped the apricot puree off Butchie's chin, rescued the milk glass, rinsed the plastic infant-food jar and dropped it in the "plastics" carton, rinsed the lid and put it in the "metals" box

and poured my coffee. We are a very ecological household. It astonishes me how good Shirl is at things like that, considering.

I waved fruit flies away from the general direction of my orange juice and put my glasses back on in time to catch her asking, wonderingly, "What would they do with our house? I mean, I'm not a demon decorator like Ginevra Freedman. I just like it comfortable and neat."

"They don't exactly want the house," I explained. "They just want the money they'll get after they sell it to somebody else." Her expression cleared at once. Shirl always likes to understand things.

I sipped my coffee, fending off Butchie's attempt to grab the cup, and folded the letter and laid it across my knees like an unsheathed scimitar, ready to taste the blood of the *giaour*, which it kind of was. Butchie indicated that he would like to eat it, but I didn't see that that would solve the problem. Although I didn't have any better way of solving it, at that.

I finished the orange juice, patted Butchie's head and, against my better judgment, gave Shirl the routine kiss on the nose.

"Well," she said, "I'm glad that's settled. Isn't it nice the way the mail comes first thing in the morning now?"

I said it was very nice and left for the bus but, really, I could have been just as happy if Undersigned's letter had come any old time. The fruit flies were pursuing me all the way down the street. They seemed to think they could get nourishment out of me, which suggested that fruit flies were about equal in intelligence to brothers-in-law. It was not a surprising thought. I had thought it before.

GARIGOLLI

To Home Base

Chief,

The mobility of this Host is a constant pain in the spermatophore. Now he's gone off on the day-cycle early, and half the crew are still stuck in this domicile. Ultimate Matrix knows how they'll handle it if we don't get back before they run out of group empathy.

You've got no reason to take that tone, Chief. We're doing a good job and you know it. "Directive One: To remain undetected by sentients on planet being explored." A hundred and forty-four p.g., right? They don't have a clue we're here, although I concede that that part is fairly easy, since they are so much bigger than we are. "Directive Three: Subject to Directive One and Two, to make a complete study of geographic, demographic, ecological and cognitic factors and to transmit same to Home Base." You actually complimented us on those! It's only Directive Two that's giving us trouble.

We're still trying, but did it ever occur to you that maybe these people don't *deserve* Directive Two?

Garigolli

I LOPED ALONG the jungle trail to the bus stop, calculating with my razor-sharp mind that the distance from the house was almost exactly 14,752.03 centimeters. As centimeters it didn't sound bad at all. As money, \$14,752.03 was the kind of sum I hadn't written down since Commercial Arithmetic in P.S. 98.

I fell in with Barney Freedman, insurance underwriter and husband of Ginevra, the Demon Decorator. "Whatever became of Commercial Arithmetic?" I asked him. "Like ninety-day notes for fourteen thousand seven hundred and fifty-two dollars and three cents at six percent simple interest? Although why anybody would be dumb enough to lend anybody money for ninety days beats me. If he doesn't have it now, he won't have it in ninety days."

"You're in some kind of trouble." "Shrewd guess."

"So what did Shirl do now?"

"She co-signed a note for her brother," I said. "When he went into the drying-out sanitarium for the gold treatment. They wouldn't take him on his own credit, for some reason. They must have goldplated him. He said the note was just a formality, so Shirl didn't bother me with it."

We turned the corner. Barney said, "Ginevra didn't bother me once when the telephone com-

pany—"

"So when Shirl's brother got undrunk," I said, "he told her not to worry about it and went to California. He thought he might catch on with the movies."

"Did he?"

"He didn't even catch cold with the movies. Then they sent us the bill. Fourteen thou-well, they had it all itemized. Three nurses. Medication. Suite. Occupational Therapy. Professional services. Hydrotherapy. Group counseling. One-to-one counseling. Limousine. Chauffeur for limousine. Chauffeur's helper for limousine. Chauffeur's helper's hard-boiled eggs for lunch. Salt for chauffeur's helper's hard-boiled—"

"You're getting hysterical," Barney said. "You mean he just skipped?" We were at the bus stop, with a gaggle of other prosperous young suburban-

ites.

I said, "Like a flat rock on a pond. So we wrote

him, and of course the letters came back. They didn't fool around, the 'Institute for Psychosomatic Adjustment' didn't."

"That's a pretty name."

"I telephoned a man up there to explain, when we got the first letter. He didn't sound pretty. Just tired. He said my wife shouldn't sign things without reading them. And he said if his house was something about joint tenancy in fee simple, he would break his wife's arm if she was the type that signed things without reading them, and keep on rebreaking it until she stopped. Meanwhile they had laid out a lot of goods and services in good faith, and what was I going to do about it?"

The bus appeared on the horizon, emitting jet trails of Diesel smog. We knotted up by the sign. "So I told him I didn't know," I said, "but I know now. I'll get sued, that's what I'll do. The Dupoirs always

have an answer to every problem."

Conversation was suspended for fifteen seconds of scrimmage while we entered the bus. Barney and I were lucky. We wound up with our heads jammed affectionately together, not too far from a window that sucked in Diesel fumes and fanned them at us. I could see the fruit flies gamely trying to get back to my ear, but they were losing the battle.

Barney said, "Hey. Couldn't you sell your house

to somebody you trusted for a dollar, and then they couldn't—"

"Yes, they could. And then we'd both go to jail. I

asked a guy in our legal department."

"Huh." The bus roared on, past knots of other prosperous young suburbanites who waved their fists at us as we passed. "How about this. I hope you won't take this the wrong way. But couldn't there be

some angle about Shirl being, uh, not exactly com-

petent to sign any kind of—

"I asked about that too, Barney. No hope. Shirl's never been hospitalized, she's never been to a shrink, she runs a house and a husband and a small boy just fine. Maybe she's a little impulsive. But a lot of people are impulsive, the man said."

GARIGOLLI

To Home Base

Chief,

I think we've got it. These people use a medium of exchange, remember? And the Host doesn't have

enough of it! What could be simpler?

With a little modification there are a couple of local organisms that should be able to concentrate the stuff out of the ambient environment, and then—

And then we're off the impaling spike! Garigolli.

THE BUS JERKED to a stop at the railroad station and we boiled out on successive rollers of humanity which beached us at separate parts of the platform.

The 8:07 slid in at 8:19 sharp and I swung aboard, my mighty thews rippling like those of the giant anthropoids among whom I had been raised. With stealthy tread and every jungle-trained sense alert I stalked a vacant seat halfway down the aisle on the left, my fangs and molars bared, my liana-bound, flint-tipped *Times* poised for the thrust of death. It wasn't my morning. Ug-Fwa the Hyena, scavenger of the mighty Limpopo, bounded from the far vestibule giving voice to his mad cackle and slipped into the vacant seat. I and the rest of the giant an-

thropoids glared, unfolded our newspapers and pretended to read.

The headlines were very interesting that morning. PRES ASKS \$14,752.03 FOR MISSILE DEFENSE. "SLICK" DUPOIR SOUGHT IN DEFAULT CASE. RUMOR RED PURGE OF BROTHER IN LAW. QUAKE DEATH TOLL SET AT 14,752.03. BODY OF SKID ROW CHARACTER IDENTIFIED AS FORMER PROSPEROUS YOUNG SUBURBANITE; BROTHER IN LAW FLIES FROM COAST, WEEPS "WHY DIDN'T HE ASK ME FOR HELP?" FOSTER PARENTS OF "BUTCHIE" DUPOIR OPEN LEGAL FIGHT AGAINST DESTITUTE MA AND PA, SAY "IF THEY LOVE HIM WHY DON'T THEY SUPPORT HIM?" GLIDER SOARS 14,752.03 MILES. DUPOIR OFF 147.52—no, that was a fly speck, not a decimal point—OFF 14,752.03 FOR NEW LOW, RAILS AND BROTHERS AND LAW MIXED IN ACTIVE TRADING. I always feel you're more efficient if you start the day with the gist of the news straight in your mind.

I arrived at the office punctually at 9:07, late enough to show that I was an executive, but not so late that Mr. Horgan would notice it. The frowning brow of my cave opened under the grim rock front that bore the legend "International Plastic Co." and I walked in, nodding good morning to several persons from the Fourteenth Floor, but being nodded to myself only by Hermie, who ran the cigar stand. Hermie cultivated my company because I was good for a dollar on the numbers two or three times a week. Little did he know that it would be many a long day before he saw a dollar of mine, perhaps as many as 14752.03 of them.

GARIGOLLI

To Home Base

Further

to my last communication, Chief,

ran into a kind of a setback. We found a suitable organic substrate and implanted a colony of modified organisms which extracted gold from environmental sources, and they were performing beautifully, depositing a film of pure metal on the substrate, which the Host was carrying with him.

Then he folded it up and threw it in a waste

receptacle.

We're still working on it, but I don't know, Chief, I don't know.

Garigolli.

I FIND IT a little difficult to explain to people what I do for a living. It has something to do with making the country plastics-conscious. I make the country plastics-conscious by writing newspaper stories about plastics which only seem to get printed in neighborhood shopping guides in Sioux Falls, Idaho. And by scripting talk features about plastics which get run from 11:55 PM to 12:00 midnight on radio stations the rest of whose programs time is devoted to public-service items like late jockey changes at Wheeling Downs. And by scripting television features which do not seem ever to be run on any station. And by handling the annual Miss Plastics contest, at least up to the point where actual contestants appear, when it is taken over by the people from the Fourteenth Floor. And by writing the monthly page of Plastics Briefs which goes out, already matted, to 2,000 papers in North America. Plastics Briefs is our best bet because each Brief is illustrated by a line drawing of a girl doing something with, to or about plastics, and her costume is always brief. As I said, all this is not easy to explain.

so when people ask me what I do I usually say, "Whatever Mr. Horgan tells me to."

The morning Mr. Horgan called me away from a conference with Jack Denny, our Briefs artist, and said: "Dupoir, that Century of Plastics Anniversary Dinner idea of yours is out. The Fourteenth Floor says it lacks thematic juice. Think of something else for a winter promotion, and think big!" He banged a plastic block on his desk with a little plastic hammer.

I said, "Mr. Horgan, how about this? Are we getting the break in the high-school chemistry textbooks we should? Are we getting the message of polythene to every boy, girl, brother in law—" He shook his head. "That's small," he said, and

He shook his head. "That's small," he said, and went on to explain: "By which I mean it isn't big. Also there is the flak we are getting from the nature nuts, which the Fourteenth Floor does not think you are dealing with in a creative way."

"I've ordered five thousand pop-up recycling bins for the test, Mr. Horgan. They're not only plastic, they're recycled plastic. We use them in my own

home, and I am confident—"

"Confidence," he said, "is when you've got your eyes so firmly fixed on the goal that you trip on a dog-doodie and fall in the crap."

I regrouped. "I think we can convert the present

opposition from the ecology movement to—"

"The ecology movement," he said, "is people who love buzzards better than babies and catfish better than cars."

I fell back on my last line of defense. "Yes, Mr. Horgan," I said.

"Personally," Mr. Horgan said, "I like seeing plastic bottles bobbing in the surf. It makes me feel, I don't know, like part of something that is going to last forever. I want you to communicate that feeling,

Dupoir. Now go get your Briefs out."

I thought of asking for a salary advance of \$14,752.03, but hesitated.

"Is there something else?"

"No, Mr. Horgan. Thank you." I left quietly.

Jack Denny was still waiting in my office, doodling still-life studies of cornucopias with fruits and nuts spilling out of them. "Look," he said, "how about this for a change? Something symbolic of the season, like 'the rich harvest of Plastics to make life more gracious,' like?"

I said kindly, You don't understand copy, Jack. Do you remember what we did for last September?"

He scowled. "A girl in halter and shorts, very brief

and tight, putting up plastic storm windows.

"That's right. Well, I've got an idea for something kind of novel this year. A little two-act drama. Act One: She's wearing halter and shorts and she's taking down the plastic screens. Act Two: She's wearing a dress and putting up the plastic storm windows. And this is important. In Act Two there's wind, and autumn leaves blowing, and the dress is kind of wind-blown tight against her. Do you know what I mean, Jack?"

He said evenly, "I was the youngest child and only boy in a family of eight. If I didn't know what you meant by now I would deserve to be put away. Sometimes I think I will be put away. Do you know what seven older sisters can do to the psychology of a sensitive young boy?" He began to shake.

"Draw Jack," I told him hastily. To give him a chance to recover himself I picked up his cornucopias. "Very nice," I said, turning them over. "Beautiful modeling. I guess you spilled some paint on this one?"

He snatched it out of my hand. "Where? That?

That's gilt. I don't even have any gilt."

"No offense, Jack. I just thought it looked kind of nice." It didn't, particularly, it was just a shiny yellow smear in a corner of the drawing.

"Nice! Sure, if you'd let me use metallic inks. If you'd go to high-gloss paper. If you'd spend a few

bucks—"

"Maybe, Jack," I said, "it'd be better, at that, if you took these back to your office. You can concentrate better there, maybe."

He went out, shaking.

I stayed in and thought about my house and brother in law and the Gudsell Medical Credit Bureau and after a while I began to shake too. Shaking, I phoned a Mr. Klaw, whom I had come to think of as my "account executive" at Gudsell.

Mr. Klaw was glad to hear from me. "You got our lawyer's note? Good, good. And exactly what arrangements are you suggesting, Mr. Dupoir?"

"I don't know," I said openly. "It catches me at a

bad time. If we could have an extension—"

"Extensions we haven't got," he said regretfully. "We had one month of extensions, and we gave you the month, and now we're fresh out. I'm really sorry, Dupoir."

"With some time I could get a second mortgage,

Mr. Klaw."

"You could at that, but not for \$14,752.03."

"Do you want to put me and my family on the street?"

"Goodness, no, Mr. Dupoir! What we want is the sanitarium's money, including our commission. And maybe we want a *little* bit to make people think before they sign things, and maybe that people who should go to the county hospital go to the county hospital instead of a frankly deluxe rest home."

"I'll call you later." I said.

"Please do," said Mr. Klaw sincerely.

Tendons slack as the limp lianas, I leafed listlessly through the dhowani-bark jujus on my desk, studying Jack Denny's draftsmanship with cornucopias. The yellow stain, I noted, seemed to be spreading, even as a brother in law's blood might spread on the sands of the doom-pit when the cobras hissed the hour of judgment.

Mr. Horgan rapped perfunctorily on the doorframe and came in. "I had the impression, Dupoir, that you had something further to ask me at our conference this morning. I've learned to back those judgments, Dupoir."

"Well, sir—" I began.

"Had that feeling about poor old Globus," he went on. "You remember Miss Globus? Crying in the file room one day. Seems she'd signed up for some kind of charm school. Couldn't pay, didn't like it, tried to back out. They wanted their money. Attached her wages. Well. Naturally, we couldn't have that sort of financial irresponsibility. I understand she's a PFC in the WAC now. What was it you wanted, Dupoir?"

"Me, Mr. Horgan? Wanted? No. Nothing at all."
"Glad we cleared that up," he grunted. "Can't do
your best work for the firm if your mind's taken up with personal problems. Remember, Dupoir. We want the country plastics conscious, and forget about those ecology freaks."

"Yes, Mr. Horgan."

"And big. Not small."

"Big it is, Mr. Horgan," I said. I rolled up Jack Denny's sketches into a thick wad and threw them at him in the door, but not before he had closed it behind him.

GARIGOLLI

To Home Base

Listen Chief,

I appreciate your trying to work out a solution for us, but you're not doing as well as we're doing, even. Not that that's much.

We tried again to meet that constant aura of medium-of-exchange need from the Host, but he destroyed the whole lash-up again. Maybe we're misunderstanding him?

Artifacts are out. He's too big to see anything we make. Energy sources don't look promising. Oh, sure, we could elaborate lesser breeds that would selectively concentrate, for instance, plutonium or one of the uraniums. I don't think this particular Host would know the difference unless the scale was very large, and then, blooie, critical mass.

Meanwhile morale is becoming troublesome. We're holding together, but I wouldn't describe the condition as good. Vellitot has been wooing Dinnoliss in spite of the secondary directives against breeding while on exploration missions. I've cautioned them both, but they don't seem to stop. The funny thing is they're both in the male phase.

Garigolli.

BETWEEN JACK DENNY and myself we got about half of the month's Plastics Briefs before quitting time. Maybe they weren't big, but they were real windblown. All factors considered, I don't think it is very much to my discredit that two hours later I was moodily drinking my seventh beer in a dark place near the railroad station.

The bartender respected my mood, the TV was off, the juke box had nothing but blues on it and

there was only one fly in my lugubrious ointment, a little man who kept trying to be friendly.

From time to time I gave him a scowl I had copied from Mr. Horgan. Then he would edge down the bar for a few minutes before edging back. Eventually he got up courage enough to talk, and I got too gloomy to crush him with my mighty thews, corded like the jungle-vines that looped from the towering nganga-palms.

He was some kind of hotel-keeper, it appeared. "My young friend, you may think you have problems, but there's no business like my business. Mortgage, insurance, state supervision, building and grounds maintenance, kitchen personnel and purchasing, linen, uniforms, the station wagon and the driver, carpet repairs—oh, God, carpet repairs! No matter how many ash trays you put around, you know what they do? They steal the ashtrays. Then they stamp out cigarettes on the carpets." He began to weep.

I told the bartender to give him another. How could I lose? If he passed out I'd be rid of him. If he recovered I would have his undying, doglike affection for several minutes, and what kind of shape was I in to sneer at that?

Besides, I had worked out some pretty interesting figures. "Did you know," I told him, "that if you spend \$1.46 a day on cigarettes, you can save \$14,752.03 by giving up smoking for 10,104 and a quarter days?"

He wasn't listening, but he wasn't weeping any more either. He was just looking lovingly at his vodka libre, or whatever it was. I tried a different tack. "When you see discarded plastic bottles bobbing in the surf," I asked, "Does it make you feel like

part of something grand and timeless that will go on forever?"

He glanced at me with distaste, then went back to adoring his drink. "Or do you like buzzards better than babies?" I asked.

"They're all babies," he said. "Nasty, smelly, up-

chucking babies."

"Who are?" I asked, having lost the thread. He shook his head mysteriously, patted his drink and tossed it down.

"Root of most evil," he said, swallowing. Then, affectionately, "Don't know where I'd be with it, don't know where I'd be without it."

He appeared to be talking about booze. "On your

way home, without it?" I suggested.

He said obscurely, "Digging ditches, without it." Then he giggled. "Greatest business in the world! But oh! the worries! The competition! And when you come down to it it's all just aversion, right?"

"I can see you have a great aversion to liquor," I

said politely.

"No, stupid! The guests."

Stiffly I signaled for Number Eight, but the bartender misunderstood and brought another for my friend, too. I said, "You have an aversion to the

guests?"

He took firm hold on the bar and attempted to look squarely into my eyes, but wound up with his left eye four inches in front of my left eye and both our right eyes staring at respective ears. "The guests must be made to feel an aversion to alcohol." he said. "Secret of the whole thing. Works. Sometimes. But oh! it costs."

Like the striking fangs of Nag, the cobra, faster than the eye can follow, my trained reflexes swept

the beer up to my lips. I drank furiously, scowling at him. "You mean to say you ran a drunk farm?" I shouted.

He was shocked. "My boy! No need to be vulgar. An 'institute', eh? Let's leave the aversion to the drunks."

"I have to tell you, sir," I declared, "that I have a personal reason for despising all proprietors of such institutions!"

He began to weep again. "You, too! Oh, the general scorn."

"In my case, there is nothing general—"

"—the hatred! The unthinking contempt. And for what?"

I snarled, "For your blood-sucking ways."

"Blood, old boy?" he said, surprised. "No, nothing like that. We don't use blood. We use gold, yes, but the gold cure's old hat. Need new gimmick. Can't use silver, too cheap. Really doesn't matter what you say you use. All aversion-drying them out, keeping them comfy and aversion. But no blood."

He wiggled his fingers for Number Nine. Moodily

I drank, glaring at him over my glass.

"In the wrong end of it, I sometimes think," he went on meditatively, staring with suspicous envy at the bartender. "He doesn't have to worry. Pour it out, pick up the money. No concern about expensive rooms standing idle, staff loafing around picking their noses, overhead going on, going on-you wouldn't believe how it goes on, whether the guests are there to pay for it or not—'
"Hah," I muttered.

"You've simply no idea what I go through," he sobbed. "And then they won't pay. No, really. Fellow beat me out of \$14,752.03 just lately. I'm taking it out of the cosigner's hide, of course, but after you pay the collection agency, what's the profit?"

I choked on the beer, but he was too deep in

sorrow to notice.

Strangling, I gasped, "Did you say fourteen thousand—?"

He nodded. "Seven hundred and fifty-two dollars, yes. And three cents. Astonishes you, doesn't it, the deadbeats in this world?"

I couldn't speak.

"You wouldn't think it," he mourned. "All those salaries. All those rooms. The hydrotherapy tubs. The water bill."

I shook my head.

"Probably you think my life's a bowl of roses,

hey?"

I managed to pry my larynx open enough to wheeze, "Up to this minute, yes, I did. You've opened my eyes."

"Drink to that," he said promptly. "Hey, bar-

man!"

But before the bartender got there with Number Ten the little man hiccoughed and slid melting to the floor, like a glacier calving into icebergs.

The bartender peered over at him. "Every damn night," he grumbled. "And who's going to get him

home this time?"

My mind working as fast as Ngo, the dancing spider, spinning her web, I succeeded in saying, "Me. Glad to oblige. Never fear."

GARIGOLLI

To Home Base

Chief,

All right, I admit we haven't been exactly 144 p.g. on this project, but there's no reason for you to get

loose. Reciting the penalties for violating the Triple Directive is uncalled-for.

Let me point out that there has been no question at any time of compliance with One or Three. And even Directive Two, well, we've done what we could. "To repay sentiments in medium suitable to them for information gained." These sentients are tricky, Chief. They don't seem to empathize, really. See our reports. They often take without giving in return among themselves, and it seems to me that under the circumstances a certain modification of Directive Two would have been quite proper.

But

I am not protesting the ruling. Especially since you've pointed out it won't do any good. When I get old and skinny enough to retire to a sling in Home Base I guess I'll get that homebase mentality too, but way out here on the surface of the exploration volume it looks different, believe me.

And what is happening with the rest of our crew back at Host's domicile I can't even guess. They must be nearly frantic by now.

Garigolli.

THERE WAS SOME DISCUSSION with a policeman he wanted to hit (apparently under the impression that the cop was his night watchman playing hookey), but I finally got the little man to the Institute for Psychosomatic Adjustment.

The mausoleum that had graduated my brother in law turned out to be three stories high, with a sun porch and a slate roof and bars on the ground-floor bay windows. It was not all that far from my house. Shirl had been pleased about that, I remembered. She said we could visit her brother a lot there, and in

fact she had gone over once or twice on Sundays, but me, I'd never set eyes on the place before.

Dagger-sharp fangs flecking white spume, none dared dispute me as I strode through the great green corridors of the rain forest. Corded thews rippling like pythons under my skin, it was child's play to carry the craven jackal to his lair. The cabbie helped me up the steps with him.

The little man, now revealed as that creature who in anticipation had seemed so much larger and hairier, revived slightly as we entered the reception hall. "Ooooh," he groaned. "Watch the bouncing, old boy. That door. My office. Leather couch. Much obliged."

I dumped him on the couch, lit a green-shaded lamp on his desk, closed the door and considered.

Mine enemy had delivered himself into my power. All I had to do was seize him by the forelock. I seemed to see the faces of my family—Shirl's smiling sweetly, Butchie's cocoa-overlaid-with oatmeal—spurring me on.

There had to be a way.

I pondered. Life had not equipped me for this occasion. Raffles or Professor Moriarity would have known what to do at once, but, ponder as I would, I couldn't think of anything to do except to go through the drawers of his desk.

Well, it was a start. But it yielded very little. Miscellaneous paper clips and sheaves of letterheads, a carton of cigarettes of a brand apparently flavored with rice wine and extract of vanilla, part of a fifth of Old Rathole and five switchblade knives, presumably taken from the inmates. There was also \$6.15 in unused postage stamps, but I quickly computed that, even if I went to the trouble of cashing them in, that would leave me \$14,745.88 short.

Of Papers to Burn there were none.

All in all, the venture was a bust. I wiped out a water glass with one of the letterheads (difficult, because they were of so high quality that they seemed likelier to shatter than to wad up), and forced down a couple of ounces of the whiskey (difficult, because it was of so low).

Obviously anything of value, like for instance cosigned agreements with brothers in law, would be in a safe, which itself would probably be in the offices of the Gudsell Medical Credit Bureau. Blackmail? But there seemed very little to work with, barring one or two curious photographs tucked in among the envelopes. Conceivably I could cause him some slight embarrassment, but nowhere near \$14,752.03 worth. I had not noticed any evidence of Red espionage that might put the little man (whose name, I learned from his letterhead, was Bermingham) away for 10,104 and a quarter days, while I saved up the price of reclaiming our liberty.

There seemed to be only one possible thing to do.

Eyes glowing like red coals behind slitted lids, I walked lightly on velvet-soft pads to the *kraal* of the witch-man. He was snoring with his mouth open. Totally vulnerable to his doom.

Only, how to inflict it?

It is not as easy as one might think to murder a person. Especially if one doesn't come prepared for it. Mr. Horgan doesn't like us to carry guns at the office, and heaven knows what Shirl would do with one if I left it around home. Anyway, I didn't have one.

Poison was a possibility. The Old Rathole suggested itself. But we'd already tried that, hadn't we?

I considered the switchblade knives. There was a

technical problem. Would you know where the heart is? Granted, it had to be inside his chest somewhere, and sooner or later I could find it. But what would I say to Mr. Bermingham after the first three or four exploratory stabs woke him up?

The only reasonably efficient method I could think of to insure Mr. Bermingham's decease was to burn the place down with him in it. Which, I quickly perceived, meant with whatever cargo of drying-out drunks the Institute now possessed in it too, behind those barred windows.

At this point I came face to face with myself.

I wasn't going to kill anybody. I wasn't going to

steal any papers.

What I was going to do was, I was going to let Mr. Klaw's lawyers go ahead and take our house, because I just didn't know how to do anything else. I hefted the switchblades in my hand, threw them against the wall and poured myself another slug of Mr. Bermingham's lousy whiskey, wishing it would kill me right there and be a lesson to him.

GARIGOLLI

To Home Base

Now,

don't get excited, Chief.

But we have another problem.

Before I get into it, I would like to remind you of a couple of things. First, I was against exploring this planet in the first place, remember? I said it was going to be very difficult, on the grounds of the difference in mass between its dominant species and us. I mean, really. Here we are, fighting member to member against dangerous beasts all the time, and

the beasts, to the Host and his race, are only microorganisms that live unnoticed in their circulatory systems, their tissues, their food and their environment. Anybody could tell that this was going to be a tough assignment, if not an impossible one.

Then there's the fact that this Host moves around so. I told you some of our crew got left in his domicile. Well, we've timed this before, and almost always he returns within 144 or 216 time-units—at most, half of one of his planet's days. It's pretty close to critical, but our crew is tough and they can survive empathy-deprival that long. Only this time he has been away, so far, nearly 432 time-units. It's bad enough for those of us who have been with him. The ones who were cut off back at his domicile must have been through the tortures of the damned.

Two of them homed in on us to report just a few time-units ago, and I'm afraid you're not going to like what's happened. They must have been pretty panicky. They decided to try meeting the Second Directive themselves. They modified some microorganisms to provide some organic chemicals they thought the Host might like.

Unfortunately the organisms turned out to have an appetite for some of the Host's household artifacts, and they're pretty well demolished. So we not only haven't given him anything to comply with Directive Two, we've taken something from him. And in the process maybe we've called attention to ourselves.

I'm giving it to you arced, Chief, because I know that's how you'd like it. I accept full responsibility.

Because I don't have any choice, do I? Garigolli.

"WHAT THE HELL," said the voice of Mr. Bermingham, from somewhere up there, "are you doing in my office?"

I opened my eyes, and he was quite right. I was in Mr. Bermingham's office. The sun was streaming through Mr. Bermingham's Venetian blinds, and Mr. Bermingham was standing over me with a selection of the switchblade knives in his hands.

I don't know how Everyman reacts to this sort of situation. I guess I ran about average. I pushed myself up on one elbow and blinked at him.

"Spastic," he muttered to himself. "Well?"

I cleared my throat. "I, uh, I think I can explain this."

He was hung over and shaking. "Go ahead! Who the devil are you?"

"Well, my name is Dupoir."

"I don't mean what's your name, I mean—Wait a minute. Dupoir?"

"Dupoir."

"As in \$14,752.03?"

"That's right, Mr. Bermingham."

"You!" he gasped. "Say, you've got some nerve coming here this way. I ought to teach you a lesson."

I scrambled to my feet. Mighty thews rippling, I tossed back my head and bellowed the death-challenge of the giant anthropoids with whom I had been raised.

Bermingham misunderstood. It probably didn't sound like a death-challenge to him. He said anxiously, "If you're going to be sick, go in there and do it. Then we're going to straighten this thing out."

I followed his pointing finger. There on one side of the foyer was the door marked Staff Washroom, and on the other the door to the street through which I had carried him. It was only the work of a second to decide which to take. I was out the door, down the steps, around the corner and hailing a fortuitous cab before he could react.

By the time I got to the house that Mr. Klaw wanted so badly to take away from us it was 7:40 on my watch. There was no chance at all that Shirl would still be asleep. There was not any very big chance that she had got to sleep at all that night, not with her faithful husband for the first time in the four years of our marriage staying out all night without warning, but no chance at all that she would be still in bed. So there would be explaining to do. Nevertheless I insinuated my key into the lock of the back door, eased it open, slipped ghost-like through and gently closed it behind me.

I smelled like a distillery, I noticed, but my keen, jungle-trained senses brought me no other message. No one was in sight or sound. Not even Butchie was either chattering or weeping to disturb the silence.

I slid silently through the mud-room into the half-bath where I kept a spare razor. I spent five minutes trying to convert myself into the image of a prosperous young executive getting ready to be half an hour late at work, but it was no easy job. There was nothing but soap to shave with, and Butchie had knocked it into the sink. What was left was a blob of jelly, sculpted into a crescent where the dripping tap had eroded it away. Still, I got clean, more or less, and shaved, less.

I entered the kitchen: and then realized that my jungle-trained senses had failed to note the presence of a pot of fresh coffee perking on the stove. I could hear it plainly enough. Smelling it was more difficult; its scent was drowned by the aroma of cheap booze that hung in the air all around me.

So I turned around and yes, there was Shirl on the

stairway, holding Butchie by one hand like Maureen O'Sullivan walking Cheeta. She wore an expression of unrelieved tragedy.

It was clearly necessary to give her an explanation at once, whether I had one or not. "Honey," I said, "I'm sorry. I met this fellow I hadn't seen in a long time, and we got to talking. I know we should have called. But by the time I realized the time it was so late I was afraid I'd wake you up."

"You can't wear that shirt to the office," she said woefully. "I ironed your blue and gray one with the

white cuffs. It's in the closet."

I paused to analyze the situation. It appeared she wasn't angry at all, only upset—which, as any husband of four years knows, is 14,752.03 times worse. In spite of the fact that the reek of booze was making me giddy and fruit flies were buzzing around Shirl's normally immaculate kitchen, I knew what I had to do. "Shirl," I said, falling to one knee, "I apologize."

That seemed to divert her. "Apologize? For what?"

"For staying out all night."

"But you explained all that. You met this fellow you hadn't seen in a long time, and you got to talking. By the time you realized the time it was so

late you were afraid you'd wake me up."

"Oh, Shirl," I cried, leaping to my feet and crushing her in my mighty thews. I would have kissed her, but the reek of stale liquor seemed even stronger. I was afraid of what close contact might do, not to mention its effect on Butchie, staring up at me with a thumb and two fingers in his mouth. We Dupoirs never do anything by halves.

But there was a tear in her eye. She said, "I watched Butchie, honestly I did. I always do. When

he broke the studio lamp I was watching every minute, remember? He was just too fast for me.'

I didn't have any idea what she was talking about. That is not an unfamiliar situation in our house, and I have developed a technique for dealing with it. "What?" I asked.

"He was too fast for me," Shirl said woefully. "When he dumped his vitamins into his raisins and oatmeal I was right there. I went to get some paper napkins, and that was when he did it. But how could I know it would ruin the plastics bin?"
I went into Phase Two. "What plastics bin?"
"Our plastics bin." She pointed. "Where Butchie

threw the stuff."

At once I saw what she meant. There was a row of four plastic popup recycling bins in our kitchen, one for paper, one for plastics, one for glass and one for metals. They were a credit to us, and to Mr. Horgan and to the Fourteenth Floor. However, the one marked "plastics" was not a credit to anyone any more. It had sprung a leak. A colorless fluid was oozing out of the bottom of it and, whatever it was, it was deeply pitting the floor tiles.

I bent closer and realized where the reek of stale booze was coming from: out of the juices that were seeping from our plastics bin.

"What the devil?" I asked.

Shirl said thoughtfully, "If vitamins can do that to plastic, what do you suppose they do to Butchie's insides?"

"It isn't the vitamins. I know that much." I reached in and booked the handle of what had been a milk jug, gallon size. It was high-density polythene and about four hundred percent more indestructible than Mount Rushmore. It was exactly the kind of plastic jug that people who loved buzzards better than babies have been complaining about finding bobbing around the surf of their favorite bathing beaches, all the world over.

Indestructible or not, it was about ninty per cent destroyed. What I pulled out was a handle and part of a neck. The rest drizzled off into a substance very like the stuff I had shaved with. Only that was soap, which one expects to dissolve from time to time. High-density polythene one does not.

The fruit flies were buzzing around me, and everything was very confusing. I was hardly aware that the front doorbell had rung until I noticed that Shirl

had gone to answer it.

What made me fully aware of this was Mr. Bermingham's triumphant roar: "Thought I'd find you here, Dupoir! And who are these people—your confederates?"

Bermingham had no terrors for me. I was past that point. I said, "Hello, Mr. Bermingham. This confederate is my wife, the littler one here is my son. Shirl, Butchie—Mr. Bermingham. Mr. Bermingham's the one who is going to take away our house."

gham's the one who is going to take away our house."
Shirl said politely, "You must be tired, Mr. Ber-

mingham. I'll get you a cup of coffee."

GARIGOLLI

to Home Base

Chief,

I

admit it, we've excreted this one out beyond redemption. Don't bother to reply to this. Just write us off.

I could say that it wasn't entirely the fault of the crew members who stayed behind in the Host's domicile. They thought they had figured out a way to meet Directive Two. They modified some organisms—didn't even use bacteria, just an enzyme that hydrated polythene into what they had every reason to believe was a standard food substance, since the Host had been observed to ingest it with some frequency. There is no wrong-doing there, Chief. Alcohols are standard foods for many organic beings, as you know. And a gift of food has been held to satisfy the second Directive. And add to that they were half out of their plexuses with empathy deprivation.

Nevertheless I admit the gift failed in a fairly basic way, since it seems to have damaged artifacts

the Hosts hold valuable.

So I accept the responsibility, Chief. Wipe this expedition off the records. We've failed, and we'll never see our home breeding-slings again.

Please notify our descendants and former co-parents and, if you can, try to let them think we died heroically, won't you?

Garigolli.

shirl has defeated the wrath of far more complex creatures than Mr. Bermingham by offering them coffee—me, for instance. While she got him the clean cup and spoon and the milk out of the pitcher in the refrigerator, I had time to think.

Mr. Horgan would be interested in what had happened to our plastic eco-bin. Not only Mr. Horgan. The Fourteenth Floor would be interested. The ecology freaks themselves would be interested, and maybe would forget about liking buzzards better than babies long enough to say a good word for International Plastics Co.

I mean, this was significant. It was big, by which I

mean it wasn't little. It was a sort of whole new horizon for plastics. The thing about plastics, as everyone knows, is that once you convert them into trash they stay trash. Bury a maple syrup jug in your back yard and five thousand years from now some descendant operating a radar-controlled peonyplanter from his back porch will grub it up as shiny as new. But the gunk in our eco-bin was making these plastics, or at least the polythene parts of them, bio-degradable.

What was the gunk? I had no idea. Some random chemical combination between Butchie's oatmeal and his vitamins? I didn't care. It was there, and it worked. If we could isolate the stuff, I had no doubt that the world-famous scientists who gave us the plastic storm window and the popup eco-bin could duplicate it. And if we could duplicate it we could sell it to hard-pressed garbagemen all over the world. The Fourteenth Floor would be very pleased.

With me to think was ever to act. I rinsed out one of Butchie's baby-food jars in the sink, scraped some of the stickiest parts of the melting plastic into it and capped it tightly. I couldn't wait to get it to the office.

Mr. Bermingham was staring at me with his mouth open. "Good Lord," he muttered, "playing with filth at his age. What psychic damage we wreak with bad early toilet-training."

I had lost interest in Mr. Bermingham. I stood up and told him, "I've got to go to work. I'd be happy to walk you as far as the bus."

"You aren't going anywhere, Dupoir! Came here to talk to you. Going to do it, too. Behavior was absolutely inexcusable, and I demand—Say,

Dupoir, you don't have a drink anywhere about the house, do you?"

"More coffee, Mr. Bermingham?" Shirl said politely. "I'm afraid we don't have anything stronger to offer you. We don't keep alcoholic beverages here, or at least not very long. Mr. Dupoir drinks them."

"Thought so," snarled Bermingham. "Recognize a drunk when I see one: shifty eyes, irrational behavior, duplicity—oh, the duplicity! Got all the

signs.

"Oh, he's not like my brother, really," Shirl said thoughtfully. "My husband doesn't go out breaking into liquor stores when he runs out, you know. But I don't drink, and Butchie doesn't drink, and so about all we ever have in the house is some cans of beer, and there aren't any of those now."

Bermingham looked at her with angry disbelief. "You too! I smell it," he said. "You going to tell me I don't know what good old ethyl alcohol smells like?"

"That's the bin, Mr. Bermingham. It's a terrible mess, I know."

"Funny place to keep the creature," he muttered to himself, dropping to his knees. He dipped a finger into the drippings, smelled it, tasted it and nodded. "Alcohol, all right. Add a few congeners, couple drops of food coloring, and you've got the finest Chivas Regal a bellboy ever sold you out of a bottle with the tax stamp broken." He stood up and glared at me. "What's the matter with you, Dupoir? You not only don't pay your honest debts, you don't want to pay the bartenders either?"

I said, "It's more or less an accident."

"Accident?"

Then illumination struck. "Accident you should find us like this," I corrected. "You see, it's a secret

new process. We're not ready to announce it yet. Making alcohol out of old plastic scraps."

He questioned Shirl with his eyes. Getting her consent, he poured some of Butchie's baby-food orange juice into a glass, scooped in some of the drippings from the bin, closed his eyes and tasted. "Mmm," he said judiciously. "Sell it for vodka just the way it stands."

"Glad to have an expert opinion," I said. "We

think there's millions in it."

He took another taste. "Plastic scraps, you say? Listen, Dupoir. Think we can clear all this up in no time. That fool Klaw, I've told him over and over, ask politely, don't make trouble for people. But no, he's got that crazy lawyer's drive for revenge. Apologize for him, old boy, I really do apologize for him. Now look," he said, putting down the glass to rub his hands. "You'll need help in putting this process on the market. Business acumen, you know? Wise counsel from man of experience. Like me. And capital. Can help you there. I'm loaded."

Shirl put in, "Then what do you want our house

for?"

"House? My dear, Mrs. Dupoir," cried Mr. Bermingham, laughing heartily, "I'm not going to take your house! Your husband and I will work out the details in no time. Let me have a little more of that delightful orange juice and we can talk some business."

GARIGOLLI

to Home Base Joy, joy

Chief!

Cancel all I said. We've met Directive Two, the Host is happy, and we're on our way Home!

Warm up the breeding slings, there's going to be a hot time in the old hammocks tonight.

Garigolli.

STRAIGHT AS THE FLIGHT of Ung-Glitch, the soaring vulture, that is the code of the jungle. I was straight with Mr. Bermingham. I didn't cheat him. I made a handshake deal with him over the ruins of our Eco-Bin, and honored it when we got to his lawyers, I traded him 40% of the beverage rights to the stuff that came out of our bin, and he wrote off that little matter of \$14,752.03.

Of course, the beverage rights turned out not to be worth all that much, because the stuff in the bin was organic and alive and capable of reproduction, and it did indeed reproduce itself enthusiastically. Six months later you could buy a starter drop of it for a quarter on any street corner, and what that has done to the vintners of the world you know as well as I do. But Bermingham came out ahead. He divided his 40% interest into forty parts and sold them for \$500 each to the alumni of his drunk tank. And Mr. Horgan—

Ah, Mr. Horgan.

Mr. Horgan was perched on my doorframe like Ung-Glitch awaiting a delivery of cadavers for dinner when I arrived that morning, bearing my little glass jar before me like the waiting line in an obstetrician's office. "You're late, Dupoir," he pointed out. "Troubles me, that does. Do you remember Metcalf? Tall, blonde girl that used to work in Accounts Receivable? Never could get in on time, and—"

"Mr. Horgan," I said, "look." And I unscrewed my baby-food jar and dumped the contents on an unpopped pop-up Eco-Bin. It took him a while to see what was happening, but once he saw he was so impressed he forgot to roar.

And, yes, the Fourteenth Floor was very pleased.

There wasn't any big money in it. We couldn't sell the stuff, because it was so happy to give itself away to everyone in the world. But it meant a promotion and a raise. Not big. But not really little either. And, as Mr. Horgan said, "I like the idea of helping to eliminate all the litter that devastates the landscape. It makes me feel, I don't know, like part of something clean and natural."

And so we got along happily as anything—happily, anyway, until the time Shirl bought the merry-go-round.

Introduction:

I had always maintained that Fred Saberhagen was the most undervalued writer in science fiction. Fortunately, nobody listened to me; when I was put in charge of acquisitions for Ace I quickly moved to put theory into practice: I acquired three written but unpublished works, commissioned three more, and stale acquired a dozen more from other publishers' back lists. Each of them has been a top performer for Ace. Quod Erat Demonstrandum. (I gloat, I preen, I strut about obnoxiously.)

Like most of Fred's work, "Birthdays" just passed the critics bu.

BIRTHDAYS

by Fred Saberhagen

One

LOOKING BACK, Bart could never clearly remember any part of his life before the day when the Ship first woke him from a long, artificially induced sleep, and guided him to the nursery to see the babies. That day and the first few that followed were very confusing to live through.

The Ship's machines, working with paint and glass and light, had made the nursery spacious-looking and cheerful. Bart counted twenty-four cribs. To count babies would have been harder, because only those who happened to be napping were in their beds. The rest crawled or sat or toddled on the soft-tiled deck, sending up a racket and getting underfoot of their attending machines and images. The babies were all the same age, just about a year old the day Bart first saw them. They wore white diapers, and some had on green hospital gowns like Bart's only of course smaller.

Bart was not tall for almost fourteen but he could easily lift one bare leg after the other over the low barrier the machines had placed to keep the little kids from tottering or crawling out of the nursery into the corridor. The corridor led in one direction to Bart's small private room and in the other—so his memory, working in a new, selective way, informed him—to the rest of the habitable Ship.

The babies squalled, gurgled, blubbered, or took time out to stare in silence at the world. They made nothing much of Bart's coming in among them. The images that the machines kept projecting and moving around the infants were of solid-looking adult humans, speaking and smiling; they evidently took Bart to be just one more image. The babies reacted more strongly to the machines because of the physical contact they had with them.

"Pick one up, if you wish," the Ship said in his ear. It was able to project its conversation so there was no way of telling just what direction the words came from. The Ship's voice sounded human, but not quite male or female, not quite young or old.

Like a good obedient boy Bart bent to have a try at picking up a baby. The chubby belly felt cool against his hands above the papery diaper and the head of dark, scanty curls turned so that the liquid brown eyes could stare at him uncertainly.

"See how the machines hold them," counseled the Ship. "Their arms are of basically the same form

as yours.

He shifted his grip.

"The prime directives under which I operate are very clear. One human parent, adoptive or real, is necessary to the successful maturation of children; images and machines are psychologically inadequate for optimum results. Therefore, after receiving some elementary preparation for the role, you will serve as adoptive parent for the first generation of colonists."

Colonists. The word evoked in Bart the abstract knowledge that the Ship had started from an orbit around Earth, and was outward bound to seed humanity somewhere among the stars. How long ago the voyage had begun, and whether he himself had witnessed that beginning, were questions that his

memory could not answer. Nor did he feel any urgency attached to them. Somewhere in Bart's lost past he had learned that the Ship was to be trusted utterly and now he could wait patiently for a better understanding of what it meant by its announcement that he was to be a parent. Meanwhile he watched the infants, played a little with them, and tried to comfort and distract those who cried. It seemed to be the thing to do.

The machines labored ceaselessly, patting, changing, feeding, washing, wiping up. Twice they dispensed cups of soup-like stuff for Bart to drink. There were no clocks to watch but he was certain that he had been in the nursery for hours. At last, one of the machines took him lightly by the arm and pointed back down the corridor whence he had come.

When he had closed himself into his little plastic-walled bedroom the Ship's voice said: "You will be given a substantial breakfast when you wake again. That will be one standard year from now."

Two

He awoke as on the first day, as if from a sound night's sleep, and at once sat up to look over the rim of his bed, which curved around him like a padded bathtub, warm and dry and clean. Just how he was being put to sleep or awakened he didn't know, but certainly there was more to it than he could see or feel; somehow his gown had been taken off him while he slept and he was naked.

There was a new gown laid out on the room's single small chair, or the same one, washed clean of baby shit and pablum, and he put it on after using the toilet and washing his hands and face. From a

panel in the wall he got his promised breakfast, consisting of a warm, milky drink in a plastic cup, and a tray holding chunks of bread, the breadcrust hot and crunchy and with pieces of fruit and cheese inside.

One standard year, the Ship had said . . . but his hands looked no bigger, nor did the muscles in his thin arms. His face looked no different in the wall mirror, and the fine tawny hair on his head had maintained its crewcut length. There were still no more than a couple of dozen brown pubic hairs curling at the bottom of his belly and he was sure he was no taller.

When he got to the nursery, though, he could well believe a year had passed: it certainly had if these were the same kids. A few were in their beds as before, but now those lying stretched out almost filled the little cribs. The majority were running about, keeping their balance reasonably skillfully for the most part, and busy with a multitude of toys. They wore shirts now, and shorts or pants over their diapers.

This time the babies were aware that Bart was more than just another image and some of them took fright at first and clung to the machines. But he kept walking around and talking to them, as the Ship instructed him to, and soon they started to warm up to him.

Again he spent the day in socializing, and this time shared the little kids' food when it was dispensed by the machines. Meaty-tasting, mildly chewy chunks of stuff, and harder, biscuit-like objects that came in both sweet and sour flavors, it tasted good enough to be adult fare. Last year—yesterday—the babies had been drinking from nip-

pled bottles, but today they got water and colored

drinks in little cups.

Though he hadn't questioned the Ship on it, Bart was still thinking over the announcement that he was to be a parent. He could imagine himself at the head of an enormous dining table, all these kids, grown a little older, sitting round it, but beyond that his imagination was soon lost. He told himself to be patient; the Ship would provide explanations and instructions as they became necessary.

The continual racket was wearying. By the time the babies were all bedded down for what must be their regular night's sleep, with the lights dimmed, he was ready to go to sleep himself. At a word from the Ship, he walked back yawning to his room.

Three

Again he seemed to be experiencing nothing more than an ordinary night of restful slumber, and again when he awoke he hadn't grown or gotten older. This time he found a pair of shorts and a pullover shirt laid out for him.

After dressing and breakfast he walked to the nursery. Before he got there he could hear a year's worth of change in the children's voices, forming clear words now as they called to one another.

When the new glass doors of the nursery opened to let Bart in, he saw that bigger beds had been installed, and the walls moved back to make more space for play. The kids looked different—and bigger again, of course. After an initial shyness, not so intense as yesterday's, they all came crowding around Bart so that he walked through a little sea of waist-high heads. Here and there a bulge of diaper still peeped out of someone's shorts.

"What's your name?" one tiny voice cried out, insistent above the babble of the others.

"Bartley. Everyone calls me Bart." Who had called him that? Family? Friends? There were still no specific memories available. "What's yours?"

"Armin." Or maybe Ermin was what the child answered. Bart wasn't sure if the speaker was a girl or a boy. The group seemed about evenly divided as to sex.

Again he ate and played with them through the day. This time all accepted his presence unquestioningly before an hour had passed—though he didn't get the feeling that any of them recalled his earlier visits. Today, he noticed, there were fewer projected images of adults about.

A little girl who said her name was Deirdre brought him a wheeled plastic toy whose axle had come loose from its containing grooves. He forced it back into place, so the wheels could turn again, and Deirdre carried it off, after a machine had made her stand still until she said "Thank you, Bart."

Counting as well as he could in the continuing melee, Bart decided that there were twelve girls and twelve boys in the group.

After dinner, when the machines had begun to pack the kids off to their beds, the Ship said to Bart: "You may remain awake for a few more hours if you wish."

He felt tired out, but not ready to sleep. "Maybe I'll read a book."

"I will provide some in your room."

Stretched out on his bed, he stared at a book for awhile without reading, then put it down and asked the air: "How long have I been here, in the Ship?"

"I have edited your memories of your past life for

good reason. Your past contains tragic and violent things. Nothing can be done about the past. We must work for the future and achieve a successful revised mission.'

"Are there any other people on board beside me and the little kids?"

"None. Much depends on you."

He lay there looking at the cover of The Young Detectives Visit Earth. Although his bed was comfortable and he was tired he didn't think he was going to be able to sleep.

But he really had no choice.

Four

Again, either his shorts and shirt were washed for him as he slept or it was a clean new outfit that he found on the chair. Breakfast as before, and he was on his way. The books had been removed and there was nothing else to do.

Two boys and two girls, grown bigger since he saw them last, were playing just inside the children's compound; Bart decided it couldn't be thought of as a nursery any more. As he approached the four caught sight of him and jumped with excitement, calling out to others, their voices coming to Bart faintly through the heavy glass doors.

As he entered it, Bart saw that their compound had been enlarged again. There were no more adult images in sight. Children came, hesitantly at first, from everywhere, some pedaling vehicles, others emerging from toy houses of multicolored blocks.
"Hi, I'm Bart," he said to those who gathered

close around. "Anybody remember me?"

"The Ship told us you were coming to see us today," a bold little girl spoke as she pushed forward. "Look, look, see the picture I drew?" It was a row of a dozen or so little circle-faces, each the same size, with lines for hair and nose and eyes, and one large face above. "That's you." In a corner the artist's name stood in big shaky letters: SHARON.

As the day went on Bart heard the names of all the other kids, though he remembered only a few. He spent his time in play with one group and another, and then read them all stories from a book about old Earth as they sat around him on the floor. When the Ship directed, he saw them off to bed.

"Am I being a good enough parent, Ship?"

"The revised mission plan is proceeding satisfactorily."

Five

All twenty-four of them were waiting for him excitedly just inside the heavy glass doors. This time they all remembered him.

"We're five now, Bart!"

"Ship says we can have a birthday party if we want—"

"—like Billy and Lynn—"

It took him a while to figure out that Billy and Lynn were characters in some children's story the Ship showed them from time to time. Lynn and Billy were twins, back on Earth somewhere, and in one episode they had evidently enjoyed an elaborate birthday celebration, complete with cake, candy, and ice cream.

"How old are you, Bart?"

"Will you have a birthday with us?"

"Sure. If the Ship will give us cake and things. Maybe we can have some real candles."

"Yayy!"

So they had the party, the Ship providing real candles and entrusting Bart with a lighter for them. The machines even brought forth small paperwrapped toys as presents for all the five-year-olds.

"Din'choo get a present, Bart?"

"No, it's not my birthday."

"When is?"

"In about a couple of months." The precise date was something else still sitting undisturbed in his memory, with blank holes knocked all around it. "This was fun. Listen, maybe we can have another birthday party when I come back tomorrow. You'll all be six, if the Ship keeps me on the same schedule."

"Tomorrow?"

"Well—next year. See, you and I are running on different schedules; I'm only awake one day every year. I expect the Ship'll put us on the same time schedule soon."

"Next year?"

Bart sighed, seeing that for them the difference between tomorrow and next year was not too clear. Especially the way he was talking.

Six

This year the difference in time schedules was much easier for them to grasp. So were a lot of other things.

Again the compound in which the children lived had been transformed. Part of it had become what Bart recognized as a school, and everybody was busy at teaching-machine consoles when he arrived.

The Ship's voice then declared a holiday for them

all.

"Let's have our birthday party!" a boy cried out.

And after Bart had talked with them all, and read them a new story as the Ship directed, and had been shown through the school by his small friends. machines wheeled out a big cake. This time there were balloons as well as little gifts of toys and candy.

"Isn't it your birthday too, Bart?"

"Well, no. Mine's coming in about a couple of months . . . in two months and two days."

"How old will you be?"

"Fourteen."

After the cake and ice cream was finished they had a good time playing games. The kids were awed by Bart's strength and speed and dexterity, and he taught them some of the skills he knew for games with balls and ropes and sticks. Now and then someone who got bumped hard in a game took time out to cry. Bart thought he could tell quicker and better than the machines just how serious the damage was.

Seven

Before the seventh-birthday party got started, Bart went through a period of rather intense questioning by a few of the kids; Fuad and Ranjan and Ora wanted to know what he was doing all the time they didn't see him, where and how he spent the vear between birthdays.

"I'm sleeping. The Ship can fix it so a person just

sleeps all the time."
"Huh," said Ranjan, doubtfully.

"Why does it want you to sleep all the time?" asked Ora. Today she had a loose front tooth she kept wiggling with her tongue.

"I don't know," Bart admitted, feeling foolish.

"Don't you get hungry?" Fuad wanted to know. "No. I guess it's not like regular sleep." Some vague knowledge of the process was available in his impersonal memory. "It's something like being frozen, only you never feel cold."

This year the games were rougher. When two or three of the boys grabbed Bart by the legs at once,

they could tip him over.

Back in his room alone after dinner, he asked: "Ship, am I really helping much, being a parent, if I just come out once a year? How long will I be on this schedule?"

"You will not be on this schedule for any substantial portion of your lifetime. A definite time limit cannot be set now, but all computation on the matter is proceeding properly."

He tried again a little later, before going to sleep,

but got essentially the same answer.

Eight

When Bart walked into the schoolroom something like boy-girl war was going on, the place in disarray, the weaker or more timid children in tears, the more aggressive screaming insults at one another and hurling toys and writing materials back and forth as missiles, over bookshelves and teaching machines turned into parapets. Adult images had been brought out by the Ship and were calling sternly and uselessly for order, and outnumbered machines were shaking some of the worst offenders by the arm and lecturing.

"Ship, can I help?" Bart cried.

"Yes. Two boys have got to a lower deck and should be brought back up." Ship's voice was calm and methodical as always, though somewhat louder than usual to be heard plainly above the screaming. "My machines are busy, and it would be helpful if

you went after the boys and got them to come up again. Go down the stairs at the end of the corridor to your right."

It was a passageway he hadn't been in before, evidently one recently opened by the ongoing enlargement of the living quarters. He found the two truants. Tang and Mal, without much trouble: there wasn't much of the lower level open to their exploration, only a loop of corridor sealed off by heavy glass doors at all other points where other passages intersected. The stair also was sealed where it went on down to still lower regions of the Ship.

The boys were glad to see Bart and willing to go back with him; they had seen enough of the sights down here, interesting though they were. Through the various sets of glass doors you could see other corridors stretching away for hundreds of meters at least. Many other doors were visible, some of which stood open to reveal static glimpses of rooms furnished for human life, but unused and empty of movement. The lights were dim in that large world outside the glass, and there was not a footstep on the dustless, polished-looking floors.

"I wonder if anybody lives there," Mal had asked,

nose against the glass.
"Nobody does," said Tang. "Let's go back up."
"Maybe we will someday," Mal said in a small thoughtful voice.

Nine

The war between the sexes was not raging today, but it still smoldered, as Bart could tell readily enough from the grimacing and hair-pulling and name-calling that flared sporadically during the day. The cake and ice cream lunch was a success, as usual, and the games were fun, though now he had to exert himself somewhat to outdo some of the other players.

A girl and a boy had a brief argument about what mathematical formula should be used to calculate the volume of the basketball they were playing with, and with a start Bart realized that now some of these kids knew things, maybe important things, that he had never learned. And he was supposed to be their parent! Or was it possible he had misunderstood what the Ship was saying?

These things still bothered him when the day was over and he had undressed and climbed back into his isolated bed. "Ship."

"Yes."

". . . nothing." He decided to let well enough alone. Ship rarely gave him a helpful answer anyway. And he wasn't really all that anxious to be a father, at least not until he was older.

Ten

Eating his usual breakfast, Bart felt for the first time a little anxious about meeting the people he was going to find waiting for him in the compound. If they were all another year older, they wouldn't be so much like small kids any more, but people with whom he would have to interact almost as an equal. He shook off his misgivings and walked out.

The kids weren't enormously bigger today, but it was certainly time to celebrate their collective tenth birthday, and they reminded Bart of this right after their first whoops of welcome. They had a big calendar drawn on the wall now, and had been crossing off days, and there was no doubt that another year had passed.

Today when several of the boys ganged up on Bart in a rough game they easily pushed him around. Not that there had been any plan on their part to gang up on him, or that they were not still impressed by his strength.

And this year there were certain moments, talking to the girls, when, oddly, Bart felt almost bashful.

Eleven

Suddenly some of the boys, Baruch and Olen in particular, were almost as tall as Bart himself. And Deirdre and Sigrid were starting to round out into the shapes of women; only just starting, but you could tell the process had begun.

Right in the middle of the cake-eating, the birthday party turned solemn, and there was a long sober discussion of early memories and hopes for the future.

All of them except Bart shared as some of their major lifetime memories the things that he had seen during the last eleven days—the old nursery, the parental images and the guardian machines, the toys and teaching devices. Of course he had missed the greater part of their history, but he had a sampling of it.

They sat there soberly sipping their sweet party drinks and talking. When it came Bart's turn to recount his early memories, he explained that the Ship must have scrambled them for him in some way, erasing large sections. "I don't even know if I was raised out of the machines like you, or if my biological parents were on board, or if I was born on Earth."

No one could give him any help with those ques-

tions. The talk went on for a long, moody time before they got around to playing games.

Twelve

Bart found himself looking up at Baruch, and level-eyed at a number of the other kids. The Ship was allowing them more freedom now, and everyone except Trac, who had a stomach-ache, had come to meet Bart right outside his room, the doors of which could only be opened by the Ship. Even Tang was there, though hobbling on a broken leg he said he had got by falling two decks down a stairwell. Ship's medical machines had neatly fixed the bones and told him he was healing.

Today the kids' collective attitude was at first so grown-up and businesslike that Bart was almost intimidated. They explained to him that they had just formed themselves into a society, modeled on old societies of Earth that they had studied through the teaching machines. Baruch had been elected president, and others chosen to fill at least half a dozen additional offices.

Even the birthday party began in an atmosphere of formality, but things soon loosened up. Bart was still stronger than Baruch, and could outwrestle him with an effort. But stocky Kichiro was now slightly stronger than he.

Thirteen

Chao, this month's president, announced early in the morning that this year's party was going to be a thirteenth birthday celebration for Bart as well as all the others. All the others chorused agreement, and Bart went along without protest, though he knew full well he had passed his real thirteenth birthday many months ago. He had not the slightest idea whether there had been any party to mark the event, so he enjoyed this one as his due.

All through the day the girls paid him a great deal of attention, to which he reacted confusedly, enjoying it all one moment and feeling tongue-tied and awkward the next. He could tell some of the boys were getting jealous.

Every night recently he had been saying goodnight with the feeling of saying farewell, knowing that never again would he meet the same people he was leaving. Tonight he tried to stay with them, but one of the machines came and took him gently by the arm and led him from the group toward his room. He looked round at the other children's faces, and saw sympathy but no help, and knew he had to go.

Fourteen

Every morning now he went to greet some strangers, boys and girls he had heard about indirectly but had never seen before. They resembled other kids he had met yesterday, and had their names, but that was all. Their bodies were melting and altering almost while Bart watched, flesh inflating and stretching over elongating bones; boys' faces sprouting elementary whiskers while their voices deepened, girls' breasts growing, girls' legs curving and rounding to spell out disturbing secret messages in visual code.

And today they could literally talk over his head. Bart was small for his age. That's what—who was it?—always used to say.

During the party, right in the middle of the ice cream and cake, a fistfight broke out between Fritz and Kichiro. They slugged away at each other so hard that Bart saw he wouldn't be able to stand up to either of them for ten seconds.

The machines just stood around like dummies and made no move to halt the fight. Fay, the current president, had to yell repeatedly to get other kids to step in and break it up.

As soon as things had settled down a little, some of the kids began drifting out of the room in pairs, a boy and a girl together kissing and maybe pawing at each other as they left. Bart felt strange and almost frightened. The kids that remained in the dining hall talked and giggled and talked, talked, talked. The conversation was about nothing important, but still it seemed important that it be going on.

Edris came to sit near Bart and talk talk talk with him. A red ribbon tied up her brown hair, but a few strands fell loose down as far as the halter that covered her breasts. Solon got jealous and came over and started an argument. Soon he and Bart were trying to think up insults to call each other.

Bart shoved Solon, who was not too big for him to think of fighting, and Solon punched Bart on the cheek, so his mouth started to bleed inside. Bart hit back, and then they grabbed each other and wrestled in deadly earnest to see who could get the other down. With furniture in the way they couldn't come to any clean conclusion. Bart saw that a couple of machines were hovering near, and Edris was watching with enjoyment. Pretty soon some of the big kids grabbed the combatants and broke up the fight.

The social atmosphere was a little strained for the rest of the day, and Bart went back to his room earlier than usual, before the machines came to urge him along.

He sat on his room's one chair, arms folded.

"Ship, I'm not being a parent. What am I really supposed to be doing?"

"Further instructions will be given you as re-

quired."

"Are you still going to wake me up only once a year?"

"The mission is proceeding according to its re-

vised schedule."

He got up and tried to walk out of the room again, but found the door immovable.

He wondered if something vital could be wrong with the Ship. Might not its planning computers have broken down like so many common machines and be making hideously wrong decisions? Though his bland, smoothed-out memory suggested this was impossible, Bart went worriedly to bed. Sleep was still mechanically fast in coming.

Fifteen

Solon had grown alarmingly large and it was with relief that Bart saw him smile in a friendly if distracted way. The inside of Bart's mouth was still sore from yesterday but Solon said hello as if he didn't recall their fight at all.

Bart's former opponent had other matters on his mind, and returned quickly to a conversation he was conducting in fierce whispers with Fritz and Himyar and one or two other boys. It was shortly concluded, and the bunch of them took off, running grimly and purposefully down a corridor. Bart looked around and realized there was no one left in the common room with him but half a dozen girls, most of whom looked worried.

Galina and Vivian came over to Bart and started trying to explain. It seemed that the boys were now

divided into two gangs, of six members each, and between the gangs existed something like open war.

"They've been fighting this way off and on for months now," Galina told him. "Always getting black eyes and bloody noses. Today looks like it might be one of the worst. It started today over whether we should have another birthday party or not." Galina, who was rather plain, was solemn most of the time, usually giving the impression she favored sobriety and order. "And the trouble is that now half the girls have gotten involved too."

Helsa and Lotis also came over, and the girls debated whether there was anything they could do to stop impending hostilities. All around them the Ship was quiet, ominously so, Bart felt. He stood by, feeling dangerously out of it all. He didn't even know the layout of the passages the girls talked about as they tried to guess where their male friends might be planning fights or ambushes.

While the other girls kept on talking to one another, Lotis came to Bart and with a gesture got him to follow her off into the Ship.

"Where're we going?" he asked, supposing some plan for peace-keeping or hiding out was being put

into effect.

"Something I want to show you." She was just barely taller than he, with straight black hair and Chinese eyes. Shortly they came out in a wide, open space, a meeting of corridors where, Bart saw, the kids had improvised a swimming pool. Decking had been taken up, and a room in the lower level flooded. Lotis pointed out how waterproof patching had been stuck in where necessary, and a water pipe tapped to fill the pool. The water looked deeper than a man's head.

Bart was impressed, but somehow disturbed, too, that they had done this much on their own. "Didn't the machines do anything to stop you?"

A flirt of her head dismissed the powers of the machines. "I'm going in. Do you know anything about swimming? People on Earth used to do it all the time. The records show them doing it in the oceans even."

Lotis pulled off her scanty clothing and slid naked down into the water. She turned over on her back and paddled, smiling knowingly up at Bart while he stared down in helpless fascination. Female nudity was not among the things on which his memory could give him reassurance. His mind lurched in turmoil this way and that.

Suddenly he heard running feet quite near at hand and turned to see a figure dash out of a side corridor. Fritz was bigger and stronger even than a year ago, but his eyes were wide and frightened; he scarcely looked at either Bart or Lotis, but came running around the pool as if pursued.

He was. Kichiro and Basil and Mal came pounding after him, carrying bludgeons made of the unscrewed legs of chairs, their faces transformed in the fury of the hunt. Bart started to run too; he realized almost at once this was a mistake but it was too late—someone, responding to his flight with instinctive pursuit, had grabbed him from behind and he was flattened on the deck beneath his captor.

Kichiro had tackled Bart, while Basil and Mal closed in on Fritz. It sounded like all of them were yelling.

Fritz broke away and fled for another corridor, but Basil was too fast and blocked his path. Fritz lunged at him in desperation and before Basil could swing his club he was slammed up against the bulkhead in a choking grip. The club dropped from Basil's hand, and Bart, pinned on the deck under Kichiro's kneeling weight, could see the whites of his eyes seeming to expand.

Mal stepped close to the struggling pair and earnestly swung his plastic chair leg. The impact made an ugly sound and Fritz let go of his enemy,

staggered back and fell.

Kichiro had started to get up, and Bart squirmed out from beneath him, tore free of a grasping hand, and ran. His one thought was to reach the safety of his own room. He had to pass between the group of boys and the pool, where Lotis, open-mouthed, clung to the side and watched.

Mal, turning wild-eyed, saw Bart coming and

raised his club for another swing—

None of them had seen the machine approach, but now it was on hand as if it had popped out of the many-paneled wall. It took the swinging club from Mal's hand as if it were a feather and in the same instant shoved him violently back, so that he stumbled over Fritz's unmoving legs and fell.

"You hurt me," Mal croaked stupidly from the floor. His hand was scraped raw, oozing blood, where it had collided with the gripper of the

machine.

The Ship said loudly to them all: "I have authority to sacrifice individuals, if I judge it necessary for the good of the mission."

No one moved or spoke as the machine walked through their shocked silence to bend over Fritz. As it picked him up, Bart saw that his eyes were half open but unseeing, and his mouth was slack.

It walked off down a corridor, carrying Fritz in its

arms. His limbs hung down, utterly limp. The other boys stirred and followed, their weapons left behind. Bart heard a slosh and trickle behind him: Lotis getting out of the pool. He did not turn to look. The machine went on for a few score meters, then stopped, facing a panel in the wall.

"Ship," Kichiro said, "that's a disposal chute." But

Fritz was already gone.

Ignored by the others, Bart ran back to his room and sat there, shivering and staring at the wall. The Ship served him his dinner without comment. He ate a little, and then soon turned to his bed, where sleep and forgetfulness never failed to come.

Sixteen

All twenty-three of the kids were waiting for him in the corridor when he stuck his head out of his room to see what might be going on. But it was all

right.

"No one's going to try to kill you this time," was one of the first things said, by a strong young man with thickening patches of dark beard on cheek and chin. With just a minor effort Bart could recognize the speaker as Kichiro, who, as Bart soon found out, was this year's president. They were having elections only once a year now, he was soon informed.

Fights were evidently much less frequent also, Bart discovered to his great relief. He overheard part of an argument as to who had tried to kill him last year; that was the closest thing to a fight that

happened on this birthday.

He also soon found out that birthdays, like gang wars, were now considered kid stuff, and today there was no party. Instead there was a good, elaborate lunch, with ice cream produced unpretentiously for dessert.

Talk turned to Bart, and his purpose in the world. He repeated to the kids everything that the Ship had ever told him about that purpose, which wasn't much.

"I wonder," Basil said to him, "what the Ship'll do with you now? I mean we obviously don't need you any more as a father or model or whatever to help us

grow."

"I dunno," said Bart, taking a little more ice cream. The kids' eyes were all sympathetic, but still their silent gaze made him uncomfortable. "Whenever I ask Ship about it, it just says the mission is proceeding as per revised schedule, or something like that."

Sigrid nodded knowingly. "Ship's that way. If it doesn't want to answer something for you, it just

won't."

Seventeen

This morning it was a relief to meet a group of stable, sane-looking people, not too much different from their namesakes he had said goodbye to the night before.

Bart soon noticed that Basil was missing from the group. "Oh, he's all right," said Ora reassuringly. "He'll be along for lunch. He goes studying the stars."

"The stars?"

"We've found a way to reach the outer hull. In one place there's a glass port where you can see the outside of the Ship, and the stars too, of course."

Bart could call up a plain picture of what stars were; sometime, somehow, he had seen them.

"What do you think about the stars, Bart?" Tang asked him patronizingly.

He didn't have a quick answer, and Armin said:

"Look, we've been working on this problem of the Ship and where it's going for seventeen years now. And Bart's put in how much time? About seventeen days."

And there was laughter, not unkind.

Eighteen

When Bart mentioned that he thought it would be fun to learn to swim, they took him to the newly remodeled and enlarged pool. Everyone was matter-of-fact about undressing and after clothes had been off for a minute or two it all seemed practically normal to Bart.

Resting on the pool's edge after some strenuous splashing, they took up again last year's discussion about the Ship and its purposes. Bart got the idea that now they talked a lot on this subject. Today he remarked that maybe soon they would be having children, so eventually people would fill up the empty rooms still waiting on the other levels.

Fuad shook his head. "The Ship's told us we're all

sterile—know what that means?

"You can't make any babies."

"That's right. Girls and men both. We can do all the sex we want, but nothing can ever happen from it."

Later, alone, Bart asked the Ship: "Am I sterile too? I mean, am I going to be, when . . ."

"No."

That was a definite answer at last, but to his old questions he still got only the old answers.

Nineteen

Bart's chronic worry that his life was going fundamentally wrong was lightened when he met his

shipmates today. They were now so obviously adults that he could produce an inner sigh of relief and decide to leave the worrying to them.

Most of the teaching machines had been removed. At the few remaining, people were abstractedly at work, printouts and papers stacked around them.

As soon as the word spread that Bart had joined them for the day, most of the adults abandoned other activities and came towering around him, smiling and calling greetings, squeezing his shoulders and ruffling his hair. A number of people wanted to show him things.

Basil took him to see the stars. They went drifting, swimming through a part of the Ship where gravity was turned off, and though there was air Basil made him wear a breathing device, just in case. Through the glass Bart looked along the curves of the hull, unreal in their great size and distances, and at the stars that looked even more unreal, like a vast bright scattering of powdered paint.

After lunch he asked to go swimming again. Lotis, in the pool with him and others, now had a peculiar slightly mottled look to her thighs that Bart eventually decided must be caused by fat under the skin. And on her left thigh was the thread-like red tracery of an enlarged vein.

After dinner Baruch and Tang took him aside "Bart—do you really like this one-day-a-year life?"

"I dunno. It's all right, I guess. The Ship must have some reason. It's taking care of us all, right?" He might have said something else, but Ship heard everything.

The men exchanged glances over his head. With several of the girls they walked him back to his room,

when the Ship called for him, and almost tucked him into bed.

Twenty

He learned soon after rejoining the others that Tang and Ora had been killed, some months ago, trying to work their way into a part of the Ship from which humans were ordinarily sealed out.

"Were they trying . . . I mean, did it have anything to do with me? With waking me up more often,

or . .

"No." Fay shook her head definitely. "Oh no, Bart, don't worry about that."

The thought hadn't really worried him. Actually it

had generated some hope.

"They were trying to get to the far end of the Ship," Ranjan explained, "You know, the aft, as the old records call it. Have you seen any of the old records? The part of the Ship where the drive controls and so many other things seem to be located."

They explained to Bart such elementary knowledge of the Ship as they had been able to piece together, and his understanding of it grew a little. He found out also that they meant to keep on trying to get through to the other parts of the Ship, and eventually to take over its control. That was a strange thought, and Bart wasn't at all sure how much he liked it.

Twenty-one

It had been many days since his shipmates paid him as little attention as they did today. He was greeted cheerfully enough, but no crowd gathered around. A couple of people went with him to swim, in a pool that had again been remodeled and made safer and more pleasant. He learned that some of the people were working hard to raise plants from seeds the Ship had long ago provided for their school biology program. They showed him the new garden. It held nothing ready to eat yet, but maybe next time he came.

He saw Kichiro limping by and heard that his

He saw Kichiro limping by and heard that his knee had been lamed in some contest with another man, but whether it was a fight or a game Bart did

not learn.

Twenty-two

There were no beds in the old common-room any more, and Bart found that most of the people had paired off two-by-two, sleeping in more or less sta-

ble partnerships.

More noticeably, most of the people he talked to today had runny noses. Sharon told him that an experiment in the new biology lab had gone wrong and some viruses had escaped. Nothing to worry about, they assured him. He wasn't worried, really, not about viruses anyway.

All in all, it was a casual, low-pressure sort of day.

Twenty-three

Lotis, working in the garden, wore shorts today, and he noticed that her legs and bottom were getting quite lumpy with fat. The red vein on her thigh had extended itself into a little tracery of defective blood vessels in the skin.

All the runny noses had dried up. Some medicine the people had made for themselves was ready for Bart in case he caught the infection too. He didn't.

"Maybe the Ship's still taking good care of you,"

Chao commented.

Twenty-four

No one came down the corridor toward his room to meet him, but as soon as Bart had entered the general living area they all jumped out of hiding with cries of "Surprise!" and "Happy birthday!" It wasn't his birthday yet, but he soon understood that a sort of general birthday had been declared in which he was being invited to share.

"It's been ten years since we've had one, Bart," said Himyar. "A party, I mean. So we just thought it

was time."

"We could make you an honorary fifteen," Fay put in. "Or how about an honorary twenty-four?" "Have a glass of wine, Bart," said someone else. "Wine?"

"Told you our garden was going to be a success."
"—oh, give him only a small one! He's too young-

"—one glass won't hurt 'im—"

He realized after a while that some of the people were passing around another kind of drug, something they sniffed up into their nostrils. But he stayed with his one glass of wine, which made him feel just dizzy and high enough to be wary of asking for any more.

The party went on practically all day, with games and jokes and songs. Bart no longer minded when people paired off and vanished for a while, their arms about each other. This behavior was grownups' doings now, not something in which he might possi-bly become involved. He went along with all the partying and had a good time. Still, now and then he caught himself wishing they would get down to bus-iness. Though he didn't know just what their business was.

Twenty-five

This year his wish seemed to have been granted, for he got the impression of a lot of serious business going on. People were punching at computers and crouched over teaching machines, and in some rooms devices Bart couldn't identify had been set up.

He noticed that Olen's hairline was receding sharply, and wondered if the man had some kind of

scalp disease. But he didn't ask.

In a large room away from the usual living area, Bart found Himyar working to form a towering metal sculpture, using a torch that showered and streamed electric flames. With this home-made device Himyar brushed the glowing metal into the shapes he wanted. Parts of the sculpture reminded Bart of flowers in the garden, or, again, of the curves of splashed water that lived momentarily when someone dived into the pool.

They talked for a time, and Himyar showed Bart some paintings Vivian had done. Himyar and Vivian spent most of their time working here or scrounging materials from every part of the Ship that they could reach; they had become known as the Artists.

"And Armin's an artist too, I suppose," said Himyar. "He's made himself a camera and goes around using it. Well, the Ship made some of the component systems for him, and the film."

"I'd like to see that."

Twenty-six

Nobody was working quite so hard today. Bart found an elaborate game in progress, a contest involving both physical and mental effort, with complicated rules. It had to do with dividing up the

regularly occupied territory of the Ship between two contending factions or teams who struggled to gain more territory from each other. People sometimes were allowed or compelled to switch sides in the game. The dividing line between the territories was marked with bright tapes stuck on the decks and bulkheads, and moved back and forth as people won or lost at events like Indian wrestling—men were matched against men, girls against girls for the physical struggles—or asking each other difficult questions.

"Bart, be referee. Wasn't his foot off the deck just hen?"

"Yep."

Powerful Kichiro, still limping on his trick knee, smiled and moved the tape into his opponents' territory by a distance of two wall panels.

"Hey, Bart!" It was Armin, approaching with something in his hand. "You never had a chance to see this. Here's a picture I took of you at the last birthday party. We'll have to have another one of those sometime."

Bart looked. "You hadn't even started with the camera when we had the party. It must have been yesterday when you took this. I mean last year, for you guys."

"Hm. I guess you're right."

Twenty-seven

He found some of the marker tapes still stuck up in place, but the game wasn't being played today and everyone seemed to have forgotten it. He met Fuad and Trac and was a little surprised to see how fat they both looked, with rolls of flesh above their shorts.

He thought of going down the passageway that led

to the stars again, but there was no breathing equipment in the locker where Basil had kept it earlier.

Baruch and Solon came along and asked what he was doing. They soon explained that the breathing equipment was being used in "engineering studies" to find out how to reach the more distant parts of the Ship.

Bart wanted to know more. They told him of the solid walls and sealed doors that cut off access to those regions, and how the Ship refused to discuss letting anyone go there. It had not tried to stop their engineering studies, though; whether it would interfere when they began to break through a wall remained to be seen.

Using explosives aboard a spaceship was intrinsically dangerous; something important and irreplaceable might be damaged, or a compartment's air might explode into vacuum.

"That's how Ora and Tang were killed. And then I was getting some acid ready to eat through a wall, and it disappeared. I suspect some machine found it and took it away." Baruch shrugged, fatalistic but still determined. "But we'll see, we'll see." He did not sound or look at all discouraged.

Twenty-eight

This year Bart got more attention from his shipmates than had been usual his last few days. Edris and Helsa looked at his teeth and wondered out loud if the Ship shouldn't be straightening some of them for him.

"Oh, they're not terribly crooked. But it did as much for some of us when we were kids."

After lunch there was a general discussion of his

future, carried on at times as if he were not there. Ranjan said: "I still think the Ship plans to provide him with a bride one of these days, one of these years. Maybe it's already tried to hatch other people from the artificial wombs and something's gone wrong, so it's got poor Bart just marking time."

Another adult asked: "You still think there's a

Another adult asked: "You still think there's a good supply of human genetic material on board?"

"Bound to be. Else the Ship wouldn't have

sterilized us, right?"

There was general agreement on that point, but on little else. One body of opinion held that the Ship really wanted the people to take over, now that its own computers had grown crotchety and unreliable with breakdowns and damage. But some kind of glitch prevented it from simply saying what it wanted. Schizophrenic, it fended off their attempts to gain control with one hand, while feeding and caring for them with the other.

The discussion soon got over Bart's head, but he listened intently, trying to weigh everything they said. He listened for something that might give him confidence, but heard it not.

Twenty-nine

"I know you've seen our biology lab before," Galina told him. "But I think you ought to take a real interest. All our futures may lie in this room."

He ceased scratching his back against the door-frame. "How so?"

"Sit down, Bart." When they were seated, she looked at him with concern. "Bart, if the machines never provide you with any people your own age—with a fertile female specifically—then it's going to be up to us to find some way to eventually produce

more people, so that the human race can go on. I'm not sure that there are any people left alive on Earth."

"I see." He nodded seriously.

Galina spoke slowly and kept studying him for his reactions. "We know that when the Ship was launched there was a large supply of human sperm and ova stored on board, all coded as to genetic type, so that people could be conceived and raised by machines when the end of the voyage drew near."

"Uh-huh."

She sighed. "I myself suspect that most and perhaps nearly all of this genetic material was lost in some kind of accident that evidently disrupted the voyage in other ways as well. The Ship speaks always of a revised schedule for the mission, a revised plan."

"I know."

"There's further evidence." She paused. "I said all the human seeds and eggs were coded as to type and potential? There's some indication in the available records that all of us now alive—except you, we don't know where you came from—were conceived from materials not considered of the highest quality. Not that we have any grave genetic defects, of course, no seriously defective material would have been placed aboard. But—not the best. This suggests to me that all the best material was somehow destroyed, and also that there may not be much material left."

Bart nodded, not knowing what else to say or do. "Except you, Bart, as I said. There may have been

"Except you, Bart, as I said. There may have been a human crew aboard before the accident whatever the accident was. You may be its only survivor. But I suppose your origins make little difference. Here you are and here we are, and there's the future to be faced. A future to be created—perhaps for the whole human race—out of whatever we have on hand. Would you like to learn something about biology?"

"I guess I'd better," said Bart.

They had a pretty good first lesson, distinguishing plants and animals, marking the first great branches of the tree of life.

"What are those marks on your face?" Bart asked on impulse a few hours later, as they were leaving the lab to go to dinner. He felt he knew Galina pretty well now and wasn't shy about getting a little more personal.

"What marks?" She raised tentative fingers to her

cheek.

"Those little lines in the skin, going out from the corners of your eyes."

Thirty

Today marked a standard month since the Ship had roused Bart from his first period of suspended animation. When he awoke, a machine equipped with measuring devices was waiting at his bedside. It quickly got busy to check his height and weight, looked into his eyes and mouth, listened at his chest.

"How much taller am I than a month ago, Ship?"

"Approximately seventy millimeters," said the expressionless voice.

"And how much heavier?"

"Approximately ninety-five grams."

"Is that good?"

It wouldn't say. But it did adjust his diet, adding a delicious, creamy drink to that very breakfast, served in his room. When he joined the other people he found Olen half bald, and learned that Basil had gone back to communing with the stars.

Galina gave him another biology lesson, more

technical and duller than the first.

Thirty-one

Today Bart heard that Dierdre was in her bed, too sick to get up.

"She always liked you, Bart," said Chao sadly.

"Go in and talk to her a little."

He went into Deirdre's room, and found her looking much sicker than any human being he had ever seen before. She also seemed too dazed to talk very much.

"Galina's been giving her drugs," Chao explained when he came out. "Otherwise the pain gets too had"

"Pain? From what?"

"They think it's cancer." Chao and others tried to

explain.

Only later did they get around to telling him that Baruch had been killed in some kind of an explosion, trying to force a passage to the forbidden areas of the Ship.

"Remember this photograph, Bart?" said Armin, cheering him up. "I took it of you at our last birthday party. We're going to have another one soon."

"You took it the year after the birthday party,

Armin."

"Oh? Maybe you're right."

Galina was busy with her other work today and never got around to teaching him biology.

Thirty-two

Deirdre had died, which came as no surprise to Bart but still left him with a hollow feeling. Thinking over matters of life and death, he stood at the edge of the garden, a high-domed region full of bright lights, vastly enlarged from the first little plot of synthetic soil. People were jogging for exercise around the walk that circled the perimeter of the garden, while others were working casually inside.

It was strange to see gray in the hair of some of them, but Bart guessed that was just one more thing that happened naturally with age. His own hair, crewcut when his shipmates were babies, was starting to fall over his forehead now.

He went to look up Basil, and asked to go out and see the stars again. Basil was willing. When they got to the observation port, he pointed out to Bart the prow of the Ship, and the aft, or the stern as they sometimes called it, where the engines and their controls were supposed to be.

"And when some people finally get back there," Bart asked, "they'll really be able to take over the whole thing?"

Basil shrugged. He was looking mainly outward, at the stars.

Thirty-three

Trac was the first person to meet Bart as he came down the corridor from his room, and as soon as she smiled in greeting he noticed that several teeth were missing from her lower jaw.

"Had a jaw cyst, Bart. At least that's what Galina and Solon say. They took it out. Spoils my famous beauty, but they think eventually they'll be able to do something about giving me artificial teeth."

"Couldn't the Ship-?"

"It wouldn't help, whether it could or not. It's giving us less and less help these days. But never mind about that, come along, we've got something to show you."

He followed along. And then they were all jumping out at him, yelling Surprise! Birthday party! The common dining room was decorated with streamers and balloons, and the table set for a feast.

"We were going to have one next year, Bart, you know, ten years from the last, but then we decided why not have it now?"

"You can be whatever age you like, Bart. Be an

honorary thirty-three with us, if you like."

"That's a third of a century, Mal," a woman cried. "Who wants to be that old?"

They were all good to him, as they usually were these days, petting and hugging him and fussing around, making it his party although it was supposed to be their birthday and he never said what honorary age he wanted. Actually he didn't want any, his own real age was good enough.

Later he found unnoticed in a corner something that he supposed had been dragged out of storage accidentally with the decorations. It was a wheeled plastic toy that he remembered fixing for Deirdre a month ago.

Thirty-four

The marking tapes were up on the bulkheads again, and a few people were playing at the question-and-wrestle game. Meanwhile some had evidently been spending a lot of time working in the garden. It was now huge, and looked like the earthly gardens pictured in the Ship's records, which none of them had ever seen in actuality.

"And now, Bart, we're going to have some prayers. Come along."

"Some what?"

"You'll see. It's another old idea that Basil's been

putting into practice lately."

They had wanted to hold the prayer meetings out by the observation port, Bart learned, but there wasn't room enough for everyone, and all had wanted to attend the first meetings at least, to see what they were going to be like. That was a month or two ago and by now attendance was dropping slightly.

Bart didn't understand the theory of prayer too well, but at the meeting Basil and the others who got up to talk seemed to be speaking not only to the Ship but to the world outside it, and to some force or

power that had made them both.

Thirty-five

When Bart emerged from his room most of his shipmates were there in the hall waiting for him, something that hadn't happened since they were sixteen, a day he could remember well. Today they were going to bring him to a meeting, they said, and at first Bart expected more prayers, but this meeting turned out to be more businesslike than that.

It was governmental council, held all day or most of the day around the big table with lunch coming as an interruption. Lunch included fruits and vegetables brought fresh from the garden, as well as the usual rations issued by the Ship.

The proceedings got rather boring for Bart, though his friends made an effort to bring him into it all. They showed him their new system of recordkeeping, of recording all the discoveries of their

research for easy access by Bart and future generations.

He looked the question at them.

"It's true, Bart," said Fay. A deep, gentle happiness glowed through her eyes at the thought. "The Ship has recently promised us, there will be future generations."

"Provided the mission is completed," someone

put in.

"Yes. Well." That was enough for Fay, and for the

people as a group.

Bart himself thought it sounded fine, but he would still like to know more. He asked the Ship for details later but got nowhere, as usual.

Thirty-six

There had been important changes made around him. He knew this the moment he started to come out of sleep. Opening his eyes a groggy second or two later, he realized that he was in a new bedroom, much like his old one but different in detail and bigger.

"Ship . . . Ship, where am I? What's happened?"

"You have been moved during your sleep into a new accommodation, Bart. There is no cause for alarm."

He got up and dressed and ate and eliminated as usual. The walls of this room were metal, and its door was thicker, as he saw when it opened for him to go out.

"Why did you move me, Ship?"

"Some of the people were attempting to reach you, to rouse you from sleep at the wrong time. They meant well but it was necessary to prevent their interference."

His door opened into a corridor he had never seen before, leading off in one direction only. It bent sharply several times and was interrupted by two sets of heavy doors that opened as Bart drew near and closed immediately after he had passed.

He found himself coming back into the peopled area of the Ship from a new direction near the biology lab. The first folk to see him dropped what they were doing and ran to give him a glad welcome.

"I told you he'd be here on schedule!" cried Mal, pounding Bart joyfully on the back. No club in Mal's

hand this time.

"Ship was just taking good care of him, that's all!" Sigrid pulled him in for a big hug against her heavy bosom.

Later he learned that an intensive effort had been made to "rescue" him from the machines, set him free from his long sleeps. The attempt had collapsed, foolishly, and no one wanted to talk about it. Then everyone had grown a little worried about Bart and all were glad to see him still coming back, if only for a day each year.

Gray was spreading in the hair of the happy crew around him, and several of the male heads were nearly bald. Many of the people looked a little fatter and squintier than when he had seen them last. They gave him a big lunch that was almost a birthday party.

Thirty-seven

Galina and Solon took him on a tour of their biology lab, which was much enlarged and changed since he had seen it last, with cages holding white rats and hamsters, raised from genetic material obtained from the Ship's stores.

"Do you think the long sleeps are harming me?" Bart asked when he had a chance.

"Harming you physically? No. I doubt it." Galina looked at him thoughtfully. "It takes an enormous amount of energy and a great deal of control equipment to keep a human being in such a sleep; even a Ship like this couldn't do it for very many people at a time. It's not just freezing in the ordinary sense, you know. Even the orbital electrons within your body's atoms are kept from moving . . . but don't worry about the physical danger of it, that's extremely small."

She was anxious to resume the biology lessons, and they went on a thorough tour of the lab.

"We haven't been able to get any human genetic material from the Ship to work with. Still, in theory it should be possible for us to produce a new human generation here, starting with just ordinary cells from our own bodies. Did I ever tell you anything about cloning cells?"
"No."

"I will. Anyway, it hasn't worked out yet. We're not sure if the Ship is interfering in some subtle way, or if there are simply problems we're not aware of."

They showed Bart masses of tissue growing in glass jars. But they had never been able to get the tissue to differentiate properly into all the organs that had to grow in concert to make a person. It looked to Bart as if they hadn't yet even come close to achieving that.

Here and there old colored tapes were stuck to the walls and overhead, but the game they represented seemed to have been utterly abandoned.

The only competition Bart heard about today was in raising the best food plants and flowers.

Thirty-eight

It was depressing to see Helsa now dragging herself around like an invalid, her arms grown thin and her ankles puffy. Others told Bart that Galina suspected some slow, incurable disease. Then they turned the talk to brighter things.

"There's a lot of card playing going on now, Bart,"

Sharon informed him.

"Card playing?"

"Poker, whist, bridge," said Ranjan. "We'll show you. They're old games we dug out of the Ship's records. Then we've also tried two new ways to get through the barriers to reach the control regions of the Ship, but neither has worked."

"We haven't really tried them yet," Fuad ob-

jected.

"Well, we've run them on the computer," Lotis put in.

"Bah, I tell you, the Ship is still using that com-

puter against us-"

"No, I keep telling you," argued Ranjan "we've got it blocked off now against any possibility of the Ship's gaining access—"

"So you think! I don't agree." The argument was heated, but still showed no sign of coming to blows.

Thirty-nine

Today there was a prayer meeting, more elaborate in ceremony but less intense in feeling than the last one Bart had attended. He noted that people's clothing, which they now made largely for themselves, was growing more elaborate too, and more voluminous; it covered more of their sagging bodies, and distracted attention from them.

Bart also noticed that a softer, more comfortable

type of chair had been manufactured somehow and was now in general use. The legs didn't look as if they could be unscrewed.

Fortu

It was birthday party time again. Only four candles adorned the big cake; each standing for ten years, as someone explained to Bart. The party was opened with a rather perfunctory prayer.

"Bet you don't remember when I took this picture

of you, Bart."
"Yes I do."

Several speeches were made, tracing the recent history of progress in science—mainly astronomical observations and biological research—and in the arts, mainly sculpture, painting, and drawing. Not much had been done lately in an engineering way, a speaker said, which Bart supposed meant they weren't getting anywhere with plans to take over the Ship.

A new president, Olen, had just been elected for a two-year term, and he pledged in a vague way to get

things moving.

All around the table the faces were puffy or lined, continuing to puddle or sag. There was more grav hair than any other color.

Forty-one

Bart found a number of people playing chess, a game they said they would teach him before the day was over.

About dinner time Basil told him something else, more confidentially. "I'm not going to give you any details, kid, nothing the Ship doesn't already know. Information you don't have can't be pumped out of you. I'll just say that this time we really know what we're doing, and we're not likely to be stopped. We've been a long time getting ready."

Forty-two

He soon learned that Basil, Mal, and Olen had set out, shortly after Bart's last waking day, on a major effort to force their way into the Ship's control areas. They were not back yet, and by now it was doubtful, to say the least, that they ever would return.

Himyar, the sculptor, proudly showed Bart a tall pair of steel doors on which he was carving the history of their little society in a series of panels. He claimed that he had devised a method of grinding stainless steel that worked beautifully.

Helsa was now much better, Bart saw with some surprise. But Sigrid looked unhealthy and was complaining of vague pains. "We're going to try something new," Bart heard Galina tell her cheerfully. Evidently the Ship was again not helping, or could not.

The garden had once more been enlarged, the entire new area being used for additional food plants.

Forty-three

Basil was back, had been back for several months, but Bart saw that there was still something new and wild and strange in his eyes and he was still emaciated. The other men weren't coming back, Basil said, and that was about all he had to tell about his great adventure.

The way Basil looked made Bart timid about pressing him with any further questions. Later he heard more of Basil's story from someone else. The

three men had tried going out into space, outside the Ship, to reach the aft where they intended to get back in. Something had gone wrong with their equipment; maybe the Ship had sabotaged it. They did get back into the Ship, luckily in a region where they could find air and water and stored food enough to keep them alive for a time, but the controls had been as much out of reach as ever. Eventually Basil had made his way back, somehow, through a maze of inner decks and passageways. He had never made it completely clear just how the other two had died, and Bart got the impression that it might be wise not to press too closely on that question.

Himyar had completed his doors and was working with Vivian on a giant mural of Earth, composed of scenes reconstructed imaginatively from old rec-

ords.

Sigrid's condition was not much changed from last year.

Fay, having recently been named president in a special election, told Bart it had been decided that he should attend school every waking day. The people were getting ready a course of study for him.

"The machines insisted on our attending school, I mean in a formal way, and I don't know why they don't with you, but never mind." She brushed back her graying hair and looked at him as if at a challenge. "It's time and past time that you formed good habits to carry you through the rest of your life."

Forty-four

Bart heard right away that Sigrid had died, only a few days ago.

Maybe this latest death was still on everyone's mind, and that was why his first day of school didn't

go too well. Lotis was teaching, and sort of skipped from subject to subject, and technique to technique. She knew it wasn't going well, and once she sighed: "Someone else will take a turn at teaching next year, I mean tomorrow. Are you able to learn anything from me, Bart?"

"Oh yes."

His day was almost over before he heard something exciting: it was no longer quite certain that Olen and Mal were dead. At least some garbled message had come in, along disused intercom channels that were thought to connect with control territory. Some almost indecipherable words about surviving. Maybe it was only garbage belched out by the vast intraship communications delay lines or memory drums, maybe not produced by any of this generation's people at all. But maybe

Forty-five

Himyar had put his clever hands to work, toiling in his improved shop, to outfit several people with eyeglasses. Studies on artificial teeth were now well under way, with Solon doing most of the research. The Ship refused to do anything along prosthetic lines for anyone, though it still treated routine minor injuries.

Bart heard Edris and Trac and Kichiro praying, but no longer to the Ship. He saw Basil, who now stared at walls instead of stars, and still said very little.

School was better today. Fuad as teacher talked with him easily and amused him with stories of old Earth

Forty-six

School again, his teacher Chao, who was grimly determined that he should learn to appreciate the beauties of geometry.

He heard that the garden was just getting over an epidemic of plant disease, caused by no one knew

what.

Ranjan had just been elected president, for an indeterminate term, and had pledged to get things moving.

The work on artificial teeth was progressing again after several setbacks. Solon and others looked into Bart's mouth again to judge whether he needed braces, but to his relief decided to let well enough, or almost well enough, alone.

Forty-seven

Bart got to see Vivian's and Himyar's finished mural, and part of a championship chess game between Armin and Basil.

He tasted a new hybrid fruit from the restored

garden.

He heard vague mention of a Golden Birthday celebration that might last for a year and should begin fairly soon.

He saw some artificial teeth in operation.

He heard with blunted shock that Fay, who had been working on and off in the biology lab, had killed herself with quick painless poison. If anyone knew the reasons, they never made them plain to Bart.

In school Himyar taught him, spiritedly but unintelligibly, about the various traditions of Earthly art.

Forty-eight

The gardeners and biologists had reported success in rejuvenating plants, and there was hope of

applying their discoveries to people. Some were saying excitedly that now they understood why the Ship in its wisdom had refused them any help along this line, while letting them work freely at it for themselves. It was beyond the very limited creative capabilities of computers; only humans could do it.

Not everyone agreed.

Bart's school went on with a whole group of teachers. They were trying music appreciation today, and no one on the Ship seemed to have a real bent in this direction.

Forty-nine

Bart noticed today that some of the people who had seemed happily and permanently paired off as sex-and-life partners were now paired off in different

pairings, and evidently just as happy.

Today in school there was some confusion about just what Bart had been taught in previous sessions, and what he might now be fairly tested on. He did well on the tests when they were finally given, and the arguing teachers were all relieved.

Fifty

Again the whole group—the fifteen still alive—was on hand to greet Bart when he came through the last heavy door that set aside his private territory. They greeted him with cheers and songs, told him today was a holiday from school, and pulled him away for what they promised would be the biggest and best birthday party yet.

Sharon had just been elected president, and at the party table made a brief speech about how, with the help of all of them, she meant to get things moving again. As she said, she certainly wasn't going to be

able to do it all by herself.

There were several games of volleyball. Playing with these old people who had the names of kids he had once briefly met, Bart found himself for a little while one of the gang. He lost himself in the game, jumped nimbly among the jiggling paunches and creaking joints, got knocked down when someone's hundred-kilo mass accidentally crashed into him.

But it was only for a little while that he belonged.

Fifty-one

He came into their living area with the feeling that they would have forgotten about keeping him in school, but no, the lessons were on as promised. Today, with Helsa teaching, Bart got a basic course in the Ship, what little the old records actually said about it and its mission, and something of what the people had been able to find out for themselves. After lunch, somewhat to Bart's surprise, Basil came in and took over for a while, describing how the hull looked from outside, and what some of the remoter portions of the Ship were like. He spoke impersonally, and rarely as if he himself had been there.

Fifty-two

The whole company was in a state of extreme excitement. About a month ago the world of the Ship had been rocked by an explosion, thought to have taken place a kilometer or two away along the hull, probably toward the aft. Whether a hurtling meteoric body had struck the hull, or there was some internal cause, was unknown.

The rumor flew by that Mal and Olen were perhaps still alive, and somehow responsible for the blast.

There was a sudden renewal of religious fervor. School was conducted in an atmosphere of tension.

Fifty-three

There had been no more explosions, nor any further hints that the lost men had survived. The crisis atmosphere was gone, and talk was again centered on the hoped-for rejuvenation treatments.

Bart saw a proud display of implanted artificial teeth. The method didn't work well in all cases yet but Solon was optimistic about improvements.

School went on. Today a team of instructors tried to teach him a little about human language and its near-infinite variations, some of which they spoke, or at least could read.

Fifty-four

Timber harvested from the enormous garden was being used to build a sort of pavilion, a roofless, high-walled structure which Bart was told would be used as a kind of social center. He thought they built it just to be building something.

Himyar was seeking treatment for arthritis, which had stiffened his fingers and interfered considerably

with his work.

Fifty-five

Fuad lay on a bed inside the finished pavilion, recuperating from what he said had been a heart attack. Galina said the ECG showed that the worst was over. Bart sat and talked for a while with Fuad, who was fatter even than last year and didn't look good.

People were swinging woven racquets, worn with use, in a game they called squash, played where the

volleyball net had been three days ago.

Fifty-six

"What I preach to you, Bart," said Basil, taking a turn at being schoolmaster, "what we have evolved here in our little world, is a complete synthesis of all mankind's old creeds and philosophies. I am really certain of this."

"How can you have a complete watchamacallit if they were always contradicting each other, like you say?"

Basil had a long answer, but Bart found it not very

satisfying.

A large part of the garden was now taken up by plants grown solely for use in the rejuvenation experiments.

Bart heard at dinner that Chao was now suffering repeated bouts of mental illness, and Galina had to keep her tranquilized and sometimes confined to her own room.

Fifty-seven

Politics had heated up suddenly. Edris, who had been acting president, had been removed from office and, as some kind of compromise Trac was in. Bart couldn't figure out what the dispute was about, except some of the people felt themselves insulted by others.

At lunch Trac made a little speech about how she meant to get things moving again, both on exploration of the Ship and the rejuvenation work, which evidently had been allowed to lapse. She said also that expanded medical facilities were needed, and the hospital should be enlarged.

Bart remembered the hospital as the pavilion or social center, but there were two chronic invalids, Fuad and Chao, living in it now.

Fifty-eight

Kichiro and Himyar were pointed out to Bart as rejuvenation patients, perhaps already on their way to growing younger, though Galina and Solon didn't want to make any definite claims just yet.

"It's helped me a great deal, too," Trac said. Bart thought to himself how much her face had wrinkled

and bagged in the last few days.

Himyar had started working in a new electronic medium, less demanding on the knuckles.

Basil was living apart now, giving much time to

fasting and prayer.

Most of the women had taken to dyeing their hair, yellow and red being favorite colors.

Fifty-nine

Great interest in chess had revived, and a huge birthday party was being planned for next year.

Hair colors were still used, but had been toned

School went on, Bart arguing with his teachers that they should show him more about the structure of the Ship than about things of old Earth that didn't seem to him to have any bearing on his present situation. Galina still pushed biology, but Bart could see that you'd have to study that for years to really get anywhere. He didn't know how much time he had to study anything.

A couple of small riding carts had been built, powered by electric motors, and Bart had some fun riding them about. His elders got angry and yelled at him when he drove too wildly.

The most popular physical game consisted of sliding plastic discs over a pattern of numbered squares on the floor

Sixty

When he woke up in his room a machine was standing beside him, waiting to give him his monthly physical. His gains in weight and height were both greater than at any time during the previous month. He counted a few more pubic hairs. This morning the creamy drink was dropped from his solitary breakfast.

The birthday party had more and fancier decorations than before, but little else was different, except that most of the people were content to just sit around and eat and drink and talk. Fuad didn't eat or drink much—he'd lost a lot of weight. But Chao, as the others said, was having a good day, and joined in merrily.

All in all, the old people had a good time. They fussed over Bart quite a bit, but he felt pretty much out of it. Not sad, really, but detached. School had been recessed for the day, though he would have liked to learn more about the Ship.

Sixty-one

Ranjan had suffered a stroke, and was lying paralyzed in the hospital, unable to move anything on his right side. Everyone seemed angry at the Ship, for what they described as cutting back more on its medical programs just as their needs were rising. Part of the space it had formerly used to give them such niggardly medical treatments as it provided had now been walled off. Something else was going on in there, they said, and nodded angrily, though they didn't know what was going on.

They questioned Bart, something like envy now mixed on their faces with the tenderness they usually accorded him these days. But he had not a scrap of information to provide.

At the moment the office of president was empty, and the question of reorganizing the government was being somewhat crankily debated.

Sixty-two

Vivian, who had been getting fat, was wasting and suffering internal pains. Ranjan was still unable to help himself at all. Bart was told these ills and a catalogue of lesser ones as if he should be just bursting with eagerness to hear them.

He was more interested in ping-pong, which was now a favorite game.

The burning social question was whether there should be an attempt at tinkering with the basic food machines to try to get a more easily chewable output from them.

Kichiro, Solon, and Armin, the only really healthy men, were undertaking an ambitious program to get themselves in shape. Edris, Galina, Sharon, Helsa, and Lotis were laughing a lot at the men and pondering a reducing program for themselves. Trac was thin already, maybe because she had trouble eating.

Sixty-three

He learned that Vivian was dead, to nobody's surprise.

His school today was conducted by Lotis, who about seven weeks ago had started to seduce him in the swimming pool. Meeting the eyes of the old gray-haired woman now, Bart thought she didn't remember that at all, which was only right; that hadn't been her in the pool at all, only someone with whom she shared a name. Today she taught him gardening.

The garden was being expanded again. A lot of the

rejuvenation plants were still there, taking up space, and not so much living room was needed for people any more, Bart supposed. There were fourteen of them alive now instead of twenty-four, and the survivors didn't move around as much as they used to.

"Remember when I took this picture of you,

Bart?"

"Yes, I do, but you don't." And he went rudely on his way, leaving Armin standing still behind him. It wasn't really Armin that bothered Bart, it was the whole situation. The future wasn't coming for these old people, but it was sure enough coming for him.

Sixty-four

Fuad had just died, of another heart attack, and Bart was solemnly conducted to see the still body being stored in a refrigeration room before they said words over it and gave it back to the Ship through a disposal chute.

"Death is a part of life, Bart," Basil explained. They hadn't given him that reasonable an explanation a couple of months ago when they murdered Fritz before his eyes. Never mind, he told himself.

The more energetic people were playing squash today, and Bart joined in for a little while. He was fussed over as usual, and after school people pressed cake and cookies on him.

Sixty-five

He had noticed for some time that his sessions in the school room (not far from the hospital, from which came now and then a querulous groaning) tended to fall into two types. In the first type a teacher tried very earnestly to cram knowledge into his head; in a lesson of the second type (sometimes conducted by the same man or woman) there were long pauses, and an air of futility hung over the

proceedings.

Today's session, starting right after lunch, was of the second type. After about an hour Sharon, his instructor, left him alone with a teaching machine, from which he abstracted information on the layout of the Ship, until that got boring. He played with the machine trivially then until they came to get him for dinner.

Sixty-six

He asked to be allowed to study on his own again, and when the request was granted he daydreamed and played with the machine for a while. The vision of young Lotis in the pool came to him, and he got up and went to see if the pool was still there.

Gray-haired Lotis, his teacher again today, discovered his unexplained desertion and came after him angrily. They quarreled, and she tried to take him by the hair and drag him back to school.

She was still a sturdy old girl, but in getting free he pushed her hard enough to knock her down. Alarmed by the way she yelled, he ran away.

Soon Kichiro came limping after him. Bart might have run some more and evaded capture, or sought the safety of his room, but he thrust out his lip and stood his ground. Kichiro slapped him and overawed him and made him come back to school, the hardest grip that Bart could remember clamped on his arm.

Sixty-seven

He heard that Ranjan had died, to everyone's relief, after six years of paralysis.

Bart went sullenly into school, under Kichiro's watchful eye.

The regular lesson hadn't gone far before Kichiro interrupted it to make a small impulsive speech. "Bart, you're about all that we old people have to live for. You and the hope that you represent, that one day there will be more people on the Ship, people who will get out from under the yoke of the machines, something we've never been able to manage. 'We have done those things we ought not to have done, and left undone those things we should have done.'"

Bart didn't know what to say.

"But all our lives make too much of a burden to be put on you, don't they?" Kichiro added with a sigh. He seemed to be pleading.

"No, it's all right with me if you feel that way."
And his teacher was happy and gave him a manly
hug. But Kichiro had missed the point. Bart no
longer cared how any of them felt about anything.

Sixty-eight

The first person he met was Armin, who told him that Chao and Basil had both died, separately and

rather suddenly, in the past year.

Bart went to school and found that they had a test programmed into the teaching machine, ready for him to take. Left alone to work, he answered a couple of the questions, and then, feeling that he had something more important to do on this day, he got up and left the school. He looked back once and then walked on. Kichiro looked older and less vigorous than he had two years before, and Bart didn't think any of the others would try to get rough with him. Not any more.

He went to the commissary and punched orders for a small birthday cake into the machine, as he had done for some of those early parties, so long ago. It seemed long to him, now.

Soon he had his cake, and the fourteen small candles he had ordered, and a lighter too. He carried the cake to a refectory table and sat down alone to eat some of it himself. He made a little ceremony of lighting the candles, but would have felt too silly singing himself any songs.

He had ordered the sweet fizzy drink he usually had at parties but soon got up and went to where the wine was always kept and poured himself a cup of

that.

Kichiro came in and stared at him a few moments before speaking. "You're supposed to be in school." The old man's voice was half startled and half angry. "What do you think you're doing?"

"It's my fourteenth birthday today. I'm having my

cake."

Kichiro stared a little longer through his puffy, old man's eyes. "Well—I'm sorry if we forgot about your birthday, but that doesn't excuse your running out in the middle of a test." He had left a door open somewhere behind him and all the time he was talking, fretful moaning complaints kept drifting from the direction of the hospital.

Armin and Helsa came into the room. "What's the matter?"

Kichiro told them, and they started arguing, Helsa for taking a different approach with the boy, as she put it, and Armin in favor of declaring another holiday. This last suggestion angered Kichiro. They were still arguing with one another when Bart finished the little piece of cake on his plate and got

up and left, practically unnoticed. This time he located the pool but found it had long been dry and empty.

Sixty-nine

Bart woke up and left his room as usual, and was surprised when the first set of heavy doors that interrupted his private corridor remained closed when he approached. Then he saw that a new doorway, leading to a new, or newly revealed, passageway had been made in the wall at right angles to the doors.

After a moment, Bart took the new way.

"The prime directives under which I operate are very clear," the Ship said in his ear. "At least one human parent is necessary for children to mature to

their full potential.

"We will arrive in less than twenty standard years within a system of planets probably suitable for colonization. From now on you will be awakened increasingly often. You will serve the first generation of colonists as parent. Like them, you have first-rate genetic potential, and perhaps you will remain in some position of leadership when they mature. Today begins your apprenticeship in this role; your elementary preparation for it, a course in the basics of human psychology, was completed yesterday."

With gradual comprehension Bart walked on, guided toward the new nursery by the polyphonic

squalling from its full cribs.

Introduction:

I would like to take this opportunity to scotch a rumor: I did not discover John Varley. That honor goes to Ed Ferman. What I did do was I published four Varley stories almost consecutively while my only knowledge of the author was that, according to his cover letter for "Gotta Sing, Gotta Dance," he had been published in F&SF and would like to break into Galaxy. No matter how much faith one has in one's judgement, it is . . . interesting to await the readers' verdict on the first when several more irrevocably follow.

As it turned out, "The Phantom of Kansas" and "Gotta Sing, Gotta Dance" both made the final ballot that year. For an author to have two Hugo nominees in the same category in the same year has not happened before or since, and apparently Herb (that's his real name) preferred being unique to just winning a Hugo—which he surely would have done had he withdrawn either of his entries from consideration.

The story you are about to read is neither of the Nominees, just, by me, the best of the four . . .

OVERDRAWN AT THE MEMORY BANK

by John Varley

IT WAS SCHOOLDAY at the Kenya disneyland. Five nine-year-olds were being shown around the medico section where Fingal lay on the recording table, the top of his skull removed, looking up into a mirror. Fingal was in a bad mood (hence the trip to the disneyland) and could have done without the children. Their teacher was doing his best, but who can control five nine-year-olds?

"What's the big green wire do, teacher?" asked a little girl, reaching out one grubby hand and touching Fingal's brain where the main recording wire

clamped to the built-in terminal.

"Lupus, I told you you weren't to touch anything. And look at you, you didn't wash your hands." The teacher took the child's hand and pulled it away.

"But what does it matter? You told us yesterday that the reason no one cares about dirt like they used

to is dirt isn't dirty anymore."

"I'm sure I didn't tell you exactly that. What I said was that when humans were forced off Earth, we took the golden opportunity to wipe out all harmful germs. When there were only three thousand people alive on the moon after the Occupation it was easy for us to sterilize everything. So the medico doesn't need to wear gloves like surgeons used to, or even wash her hands. There's no danger of infection.

But it isn't polite. We don't want this man to think we're being impolite to him, just because his nervous system is disconnected and he can't do anything about it, do we?"

"No, teacher."

"What's a surgeon?"

"What's infection?"

Fingal wished the little perishers had chosen another day for their lessons, but like the teacher had said, there was very little he could do. The medico had turned his motor control over to the computer while she took the reading. He was paralyzed. He eyed the little boy carrying the carved stick, and hoped he didn't get a notion to poke him in the cerebrum with it. Fingal was insured, but who needs the trouble?

"All of you stand back a little so the medico can do her work. That's better. Now, who can tell me what

the big green wire is? Destry?"

Destry allowed as how he didn't know, didn't care, and wished he could get out of here and play spat ball. The teacher dismissed him and went on with the others.

"The green wire is the main sounding electrode," the teacher said. "It's attached to a series of very fine wires in the man's head, like the ones you have, which are implanted at birth. Can anyone tell me how the recording is made?"

The little girl with the dirty hands spoke up.

"By tying knots in string."

The teacher laughed, but the medico didn't. She had heard it all before. So had the teacher, of course, but that was why he was a teacher. He had the patience to deal with children, a rare quality now that there were so few of them.

"No, that was just an analogy. Can you all say analogy?"

"Analogy," they chorused.

"Fine. What I told you is that the chains of FPNA are very much like strings with knots tied in them. If you make up a code with every millimeter and every knot having a meaning, you could write words in string by tying knots in it. That's what the machine does with the FPNA. Now . . . can anyone tell me what FPNA stands for?"

"Ferro-Photo-Nucleic Acid," said the girl, who

seemed to be the star pupil.

"That's right, Lupus. It's a variant on DNA, and it can be knotted by magnetic fields and light, and made to go through chemical changes. What the medico is doing now is threading long strings of FPNA into the tiny tubes that are in the man's brain. When she's done, she'll switch on the machine and the current will start tying knots. And what happens then?"

"All his memories go into the memory cube," said

Lupus.

"That's right. But it's a little more complicated than that. You remember what I told you about a divided cipher? The kind that has two parts, neither of which is any good without the other? Imagine two of the strings, each with a lot of knots in them. Well, you try to read one of them with your decoder, and you find out that it doesn't make sense. That's because whoever wrote it used two strings, with knots tied in different places. They only make sense when you put them side-by-side and read them that way. That's how this decoder works, but the medico uses twenty-five strings. When they're all knotted the right way and put into the right openings in that

cube over there," he pointed to the pink cube in the medico's bench, "they'll contain all this man's memories and personality, In a way, he'll be in the cube, but he won't know it, because he's going to be an African lion today."

This excited the children, who would much rather be stalking the Kenya savanna than listening to how a multi-holo was taken. When they quieted down the teacher went on, using analogies that got more strained by the minute.

"When the strings are in . . . class, pay attention. When they're in the cube, a current sets them in place. What we have then is a multi-holo. Can anyone tell me why we can't just take a tape-recording of what's going on in this man's brain, and use that?"

One of the boys answered, for once.

"Because memory isn't . . . what's that word?"

"Sequential?"

"Yeah, that's it. His memories are stashed all over his brain and there's no way to sort them out. So this recorder takes a picture of the whole thing at once like a hologram. Does that mean you can cut the cube in half and have two people?"

"No, but that's a good question. This isn't that sort of hologram. This is something like . . . like when you press your hand into clay, but in four dimensions. If you chip off a part of the clay after it's dried, you lose part of the information, right? Well, this is sort of like that. You can't see the imprint because it's too small, but everything the man ever did and saw and heard and thought will be in the cube."

"Would you move back a little?" asked the medico. The children in the mirror over Fingal's head shuffled back and became more than just heads with shoulders sticking out. The medico adjusted

the last strand of FPNA suspended in his cortex to the close tolerances specified by the computer.

"I'd like to be a medico when I grow up," said one

boy.

"I thought you wanted to go to college and study to be a scientist."

"Well, maybe. But my friend is teaching me to be a medico. It looks a lot easier."

"You should stay in school, Destry. I'm sure your parent will want you to make something of yourself." The medico fumed silently. She knew better than to speak up—education was a serious business and interference with the duties of a teacher carried a stiff fine. But she was obviously pleased when the class thanked her and went out the door, leaving dirty footprints behind them.

She viciously flipped a switch, and Fingal found he could breathe and move the muscles in his head.

"Lousy conceited college graduate," she said. "What the hell's wrong with getting your hands dirty, I ask you?" She wiped the blood from her hands onto her blue smock.

"Teachers are the worst," Fingal said.

"Ain't it the truth? Well, being a medico is nothing to be ashamed of. So I didn't go to college, so what? I can do my job, and I can see what I've done when I'm through. I always did like working with my hands. Did you know that being a medico used to be one of the most respected professions there was?"

"Really?"

"Fact. They had to go to college for years and years, and they made a hell of a lot of money, let me tell you."

Fingal said nothing, thinking she must be exaggerating. What was so tough about medicine?

Just a little mechanical sense and a steady hand, that was all you needed. Fingal did a lot of maintenance on his body himself, going to the shop only for major work. And a good thing, at the prices they charged. It was not the sort of thing one discussed while lying helpless on the table, however.

"Okay, that's done." She pulled out the modules

"Okay, that's done." She pulled out the modules that contained the invisible FPNA and set them in the developing solution. She fastened Fingal's skull back on and tightened the recessed screws set into the bone. She turned his motor control back over to him while she sealed his scalp back into place. He stretched and yawned. He always grew sleepy in the medico's shop; he didn't know why.

"Will that be all for today, sir? We've got a special on blood changes, and since you'll just be lying there while you're out doppling in the park, you might as well

"No, thanks. I had it changed a year ago. Didn't you read my history?"

She picked up the card and glanced at it. "So you did. Fine. You can get up now, Mr. Fingal." She made a note on the card and set it down on the table. The door opened and a small face peered in.
"I left my stick," said the boy. He came in and

"I left my stick," said the boy. He came in and started looking under things, to the annoyance of the medico. She attempted to ignore the boy as she took down the rest of the information she needed.

"And are you going to experience this holiday now, or wait until your double has finished and play it back then?"

"Huh? Oh, you mean . . . yes, I see. No, I'll go right into the animal. My psychist advised me to come out here for my nerves, so it wouldn't do me much good to wait it out, would it?"

"No, I suppose it wouldn't. So you'll be sleeping

here while you dopple in the park. Hey!" She turned to confront the little boy, who was poking his nose into things he should stay away from. She grabbed him and pulled him away.

"You either find what you're looking for in one minute or you get out of here, you see?" He went back to his search, giggling behind his hand and looking for more interesting things to fool around with.

The medico made a check on the card, glanced at the glowing numbers on her thumbnail and discovered her shift was almost over. She connected the memory cube through a machine to a terminal in the back of his head.

"You've never done this before, right? We do this to avoid blank spots, which can be confusing sometimes. The cube is almost set, but now I'll add the last ten minutes to the record at the same time as I put you to sleep. That way you'll experience no disorientation, you'll move through a dream state to full awareness of being in the body of a lion. Your body will be removed and taken to one of our slumber rooms while you're gone. There's nothing to worry about."

Fingal wasn't worried, just tired and tense. He wished she would go on and do it and stop talking about it. And he wished the little boy would stop pounding his stick against the table leg. He wondered if his headache would be transferred to the lion.

She turned him off.

They hauled his body away and took his memory cube to the installation room. The medico chased

the boy into the corridor and hosed down the recording room. Then she was off to a date she was already late for.

The employees of Kenya disneyland installed the cube into a metal box set into the skull of a fullgrown African lioness. The social structure of lions being what it was, the proprietors charged a premium for the use of a male body, but Fingal didn't care one way or the other.

A short ride in an underground railroad with the sedated body of the Fingal-lioness, and he was deposited beneath the blazing sun of the Kenya savanna. He awoke, sniffed the air, and felt better immediately.

The Kenya disneyland was a total environment buried twenty kilometers beneath Mare Moscoviense on the farside of Luna. It was roughly circular with a radius of two hundred kilometers. From the ground to the "sky" was two kilometers except over the full-sized replica of Kilimanjaro, where it bulged to allow clouds to form in a realistic manner over the snowcap.

The illusion was flawless. The ground curved away consistent with the curvature of the Earth, so that the horizon was much more distant than anything Fingal was used to. The trees were real, and so were all the animals. At night an astronomer would have needed a spectroscope to distinguish the stars from the real thing.

Fingal certainly couldn't spot anything wrong. Not that he wanted to. The colors were strange but that was from the limitations of feline optics. Sounds were much more vivid, as were smells. If he'd thought about it, he would have realized the gravity was much too weak for Kenya. But he wasn't thinking; he'd come here to avoid that necessity.

It was hot and glorious. The dry grass made no sound as he walked over it on broad pads. He smelled antelope, wildebeest, and . . . was that baboon? He felt pangs of hunger but he really didn't want to hunt. But he found the lioness body starting on a stalk anyway.

Fingal was in an odd position. He was in control of the lioness, but only more or less. He could guide her where he wanted to go, but he had no say at all over instinctive behaviors. He was as much a pawn to these as the lioness was. In one sense, he was the lioness; when he wished to raise a paw or turn around, he simply did it. The motor control was complete. It felt great to walk on all fours, and it came as easily as breathing. But the scent of the antelope went on a direct route from the nostrils to the lower brain, made a connection with the rumblings of hunger, and started him on the stalk.

The guidebook said to surrender to it. Fighting it wouldn't do anyone any good, and could frustrate you. If you were paying to be a lion, read the chapter on "Things to Do," you might as well be one, not just

wear the body and see the sights.

Fingal wasn't sure he liked this as he came up downwind and crouched behind a withered clump of scrub. He pondered it while he sized up the dozen or so antelope grazing just a few meters from him, picking out the small, the weak, and the young with a predator's eye. Maybe he should back out now and go on his way. These beautiful creatures were not harming him. The Fingal part of him wished mostly to admire them, not eat them.

Before he quite knew what had happened, he was standing triumphant over the bloody body of a small antelope. The others were just dusty trails in the distance.

It had been incredible!

The lioness was fast, but might as well have been moving in slow-motion compared to the antelope. Her only advantage lay in surprise, confusion, and quick, all-out attack. There had been the lifting of a head, ears had flicked toward the bush he was hiding in, and he had exploded. Ten seconds of furious exertion and he bit down on a soft throat, felt the blood gush and the dying kicks of the hind legs under his paws. He was breathing hard and the blood coursed through his veins. There was only one way to release the tension.

He threw his head back and roared his bloodlust.

He'd had it with lions at the end of the weekend. It wasn't worth it for the few minutes of exhiliration at the kill. It was a life of endless stalking, countless failures, then a pitiful struggle to get a few bites for yourself from the kill you had made. He found to his chagrin that his lioness was very low in the dominance-order. When he got his kill back to the pride—he didn't know why he had dragged it back but the lioness seemed to know—it was promptly stolen from him. He/she sat back helplessly and watched the dominant male take his share, followed by the rest of the pride. He was left with a dried haunch four hours later, and had to contest even that with vultures and hyenas. He saw what the premium payment was for. That male had it easy.

But he had to admit that it had been worth it. He felt better; his psychist had been right. It did one good to leave the insatiable computers at his office for a weekend of simple living. There were no com-

plicated choices to be made out here. If he was in doubt, he listened to his instinct. It was just that the next time, he'd go as an elephant. He'd been watching them. All the other animals pretty much left them alone, and he could see why. To be a solitary bull, free to wander where he wished with food as close as the nearest tree branch. . .

He was still thinking about it when the collection crew came for him.

He awoke with the vague feeling that something was wrong. He sat up in bed and looked around him. Nothing seemed to be out of place. There was no one

in the room with him. He shook his head to clear it.
It didn't do any good. There was still something

wrong. He tried to remember how he had gotten there, and laughed at himself. His own bedroom!

What was so remarkable about that?

But hadn't there been a vacation, a week-end trip? He remembered being a lion, eating raw antelope meat, being pushed around within the pride, fighting it out with the other females and losing and retiring to rumble to him/herself.

Certainly he should have come back to human consciousness in the disneyland medical section. He couldn't remember it. He reached for his phone, not knowing who he wished to call. His psychist, perhaps, or the Kenya office.

"I'm sorry, Mr. Fingal," the phone told him. "This line is no longer available for outgoing calls. If

you'll . . ."

"Why not?" he asked, irritated and confused. "I paid my bill."

"That is of no concern to this department, Mr. Fingal. And please do not interrupt. It's hard enough to reach you. I'm fading, but the message will be continued if you look to your right." The voice and the power hum behind it faded. The phone was dead.

Fingal looked to his right and jerked in surprise. There was a hand, a woman's hand, writing on his

wall. The hand faded out at the wrist.

"Mene, Mene..." it wrote, in thin letters of fire. Then the hand waved in irritation and erased that with its thumb. The wall was smudged with soot where the words had been.

"You're projecting, Mr. Fingal." the hand wrote, quickly etching out the words with a manicured nail.

"That's what you expected to see." The hand underlined the word "expected" three times. "Please cooperate, clear your mind, and see what is there, or we're not going to get anywhere. Damn, I've about exhausted this medium."

And indeed it had. The writing had filled the wall and the hand was now down near the floor. The apparition wrote smaller and smaller in an effort to get it all in.

Fingal had an excellent grasp on reality, according to his psychist. He held tightly onto that evaluation like a talisman as he leaned closer to the wall to read the last sentence.

"Look on your bookshelf," the hand wrote. "The title is Orientation in your Fantasy World."

Fingal knew he had no such book, but could think of nothing better to do.

His phone didn't work, and if he was going through a psychotic episode he didn't think it wise to enter the public corridor until he had some idea of what was going on. The hand faded out, but the writing continued to smoulder.

He found the book easily enough. It was a pamphlet, actually, with a gaudy cover. It was the sort of thing he had seen in the outer offices of the Kenya disneyland, a promotional booklet. At the bottom it said, "Published under the auspices of the Kenya computer; A. Joachim, operator." He opened it and began to read.

CHAPTER ONE "Where Am I?"

You're probably wondering by now where you are. This is an entirely healthy and normal reaction, Mr. Fingal. Anyone would wonder, when beset by what seem to be paranormal manifestations, if his grasp on reality had weakened. Or, in simple language, "Am I nuts, or what?"

No, Mr. Fingal, you are not nuts. But you are not, as you probably think, sitting on your bed, reading a book. It's all in your mind. You are still in the Kenya disneyland. More specifically, you are contained in the memory cube we took of you before your weekend on the savanna. You see, there's been a big goof-up.

CHAPTER TWO "What Happened?"

We'd like to know that, too, Mr. Fingal. But here's what we do know. Your body has been misplaced. Now, there's nothing to worry about, we're doing all we can to locate it and find out how it happened but it will take some time. Maybe it's small consolation but this has never happened before in the seventy-five years we've been operating and as

soon as we find out how it happened this time, you can be sure we'll be careful not to let it happen again. We're pursuing several leads at this time, and you can rest easy that your body will be returned to you intact just as soon as we locate it.

You are awake and aware right now because we have incorporated your memory cube into the workings of our H-210 computer, one of the finest holo-memory systems available to modern business. You see, there are a few problems.

CHAPTER THREE "What Problems?"

It's kind of hard to put in terms you'd understand, but let's take a crack at it, shall we?

The medium we use to record your memories isn't the one you've probably used yourself as insurance against accidental death. As you must know, that system will store your memories for up to twenty years with no degradation or loss of information, and is quite expensive. The system we formation, and is quite expensive. The system we use is a temporary one, good for two, five, fourteen, or twenty-eight days, depending on the length of your stay. Your memories are put in the cube, where you might expect them to remain static and unchanging, like they do in your insurance-recording. If you thought that, you would be wrong, Mr. Fingal. Think about it. If you die, your bank will immediately start a clone from the plasma you stored along with the memory cube. In six months, your memories would be played back into the clone and you would awaken, missing the memories that were accumulated in your body from the time of your last recording. Perhaps this has happened to you. If it has, you know the shock of wakening from the recording process to be told that it is three or four years later, and that you died in that time.

In any case, the process we use is an *ongoing* one, or it would be worthless to you. The cube we install in the African animal of your choice is capable of adding the memories of your stay in Kenya to the memory cube. When your visit is over, these memories are played back into your brain and you leave the disneyland with the exciting, educational, and refreshing experiences you had as an animal, though your body never left our slumber room. This is known as "doppling," from the German *doppel-ganger*.

Now, to the problems we talked about. Thought we'd never get around to them, didn't you?

First, since you registered for a week-end stay, the medico naturally used one of the two-day cubes as part of our budget-excursion fare. These cubes have a safety factor, but aren't much good beyond three days at best. At the end of that time the cube would start to deteriorate. Of course, we fully expect to have you installed in your own body before then. Additionally, there is the problem of storage. Since these ongoing memory cubes are intended to be in use all the time your memories are stored in them, it presents certain problems when we find ourselves in the spot we are now in. Are you following me, Mr. Fingal? While the cube has already passed its potency for use in coexisting with a live host, like the lioness you just left, it *must* be kept in constant activation at all times or loss of information results. I'm sure you wouldn't want that to happen, would you? Of course not. So what we have done is to "plug you

in" to our computer, which will keep you aware and healthy and guard against the randomizing of your memory nexi. I won't go into that; let it stand that randomizing is not the sort of thing you'd like to have happen to you.

CHAPTER FOUR "So What Gives, Huh?"

I'm glad you asked that. (Because you did ask that, Mr. Fingal. This booklet is part of the analogizing process that I'll explain further down the page.)

Life in a computer is not the sort of thing you could just jump into and hope to retain the world-picture-compatibility so necessary for sane functioning in this complex society. This has been tried, so take our word for it. Or rather, my word. Did I introduce myoulf? I'm Apollogic leaching First introduce myself? I'm Apollonia Joachim, First Class Operative for the DataSafe computer trouble-shooting firm. You've probably never heard of us, even though you do work with computers.

puters.

Since you can't just come aware in the baffling, on-and-off world that passes for reality in a data system, your mind, in cooperation with an analogizing program I've given the computer, interprets things in ways that seem safe and comfortable to it. The world you see around you is a figment of your imagination. Of course, it looks real to you because it comes from the same part of the mind that you normally use to interpret reality. If we wanted to get philosophical about it, we could probably argue all day about what constitutes reality and why the one you are perceiving now is any ity and why the one you are perceiving now is any less real than the one you are used to. But let's not get into that, all right?

The world will likely continue to function in ways you are accustomed for it to function. It won't be exactly the same. Nightmares, for instance. Mr. Fingal, I hope you aren't the nervous type, because your nightmares can come to life where you are. They'll seem quite real. You should avoid them if you can, because they can do you real harm. I'll say more about this later if I need to. For now, there's no need to worry.

CHAPTER FIVE "What Do I Do Now?"

I'd advise you to continue with your normal activities. Don't be alarmed at anything unusual. For one thing, I can only communicate with you by means of paranormal phenomena. You see, when a message from me is fed into the computer it reaches you in a way your brain is not capable of dealing with. Naturally, your brain classifies this as an unusual event and fleshes the communication out in unusual fashion. Most of the weird things you see, if you stay calm and don't let your own fears out of the closet to persecute you, will be me. Otherwise, I anticipate that your world should look, feel, taste, sound, and smell pretty normal. I've talked to your psychist. He assures me that your world-grasp is strong. So sit tight. We'll be working hard to get you out of there.

CHAPTER SIX "Help!"

Yes, we'll help you. This is a truly unfortunate thing to have happened, and of course we will refund all your money promptly. In addition, the lawyer for Kenya wants me to ask you if a lump

sum settlement against all future damages is a topic worthy of discussion. You can think about it, there's no hurry.

In the meantime, I'll find ways to answer your questions. It might become unwieldy the harder your mind struggles to normalize my communications into things you are familiar with. That is both your greatest strength—the ability of your mind to bend the computer world it doesn't wish to see into media you are familiar with—and my biggest handicap. Look for me in tealeaves, on billboards, on holovision; anywhere! It could be exciting if you get into it.

Meanwhile, if you have received this message you can talk to me by filling in the attached coupon and dropping it in the mailtube. Your reply will probably be waiting for you at the office. Good luck!

Yes! I received your message, and am interested in the exciting opportunities in the field of *computer living!* Please send me, without cost or obligation, your exciting catalog telling me how I can *move up* to the big, wonderful world outside!

NAME																	
ADDRESS																	
I.D																	

Fingal fought the urge to pinch himself. If what this booklet said was true—and he might as well believe it—it would hurt and he would not wake up. He pinched himself anyway. It hurt.

If he understood this right, everything around

If he understood this right, everything around him was the product of his imagination. Somewhere, a woman was sitting at a computer input and talking to him in normal language, which came to his brain in the form of electron pulses it could not cope with and so edited into forms he was conversant with. He was analogizing like mad. He wondered if he had caught it from the teacher, if analogies were contagious.

"What the hell's wrong with a simple voice from the air?" he wondered aloud. He got no response, and was rather glad. He'd had enough mysteriousness for now. And on second thought, a voice from the air would probably scare the pants off him.

He decided his brain must know what it was doing. After all, the hand startled him but he hadn't panicked. He could see it, and he trusted his visual sense more than he did voices from the air, a classical sign of insanity if ever there was one.

He got up and went to the wall. The letters of fire were gone, but the black smudge of the erasure was still there. He sniffed it: carbon. He fingered the rough paper of the pamphlet, tore off a corner, put it in his mouth and chewed it. It tasted like paper.

He sat down and filled out the coupon and tossed it to the mailtube.

Fingal didn't get angry about it until he was at the office. He was an easy-going person, slow to boil. But he finally reached a point where he had to say something.

Everything had been so normal he wanted to laugh. All his friends and acquaintances were there, doing exactly what he would have expected them to be doing. What amazed and bemused him was the number and variety of spear-carriers, minor players in this internal soap-opera. The extras that his mind had cooked up to people the crowded corridors; like the man he didn't know who had bumped into him

on the tube to work, apologized, and disappeared, presumably back into the bowels of his imagination.

There was nothing he could do to vent his anger but test the whole absurd set-up. There was doubt lingering in his mind that the whole morning had been a fugue, a temporary lapse into dreamland. Maybe he'd never gone to Kenya, after all, and his mind was playing tricks on him. To get him there, or keep him away? He didn't know, but he could worry about that if the test failed.

He stood up at his desk-terminal, which was in the third column of the fifteenth row of other identical desks, each with its diligent worker. He held up his

hands and whistled. Everyone looked up.
"I don't believe in you," he screeched. He picked up a stack of tapes on his desk and hurled them at Felicia Nahum at the desk next to his. Felicia was a good friend of his, and she registered the proper shock until the tapes hit her. Then she melted. He looked around the room and saw that everything had stopped like a freeze-frame in a motion picture.

He sat down and drummed his fingers on his desk top. His heart was pounding and his face was flushed. For an awful moment he had thought he was wrong. He began to calm down, glancing up every few seconds to be sure the world really had

stopped.

In three minutes he was in a cold sweat. What the hell had he proved? That this morning had been real, or that he really was crazy? It dawned on him that he would never be able to test the assumptions under which he lived. A line of print flashed across his terminal.

"But when could you ever do so, Mr. Fingal?"
"Ms. Joachim?" he shouted, looking around him.

"Where are you? I'm afraid."

"You mustn't be," the terminal printed. "Calm yourself. You have a strong sense of reality, remember? Think about this: even before today, how could you be sure the world you saw was not the result of catatonic delusions? Do you see what I mean? The question 'What is reality?' is, in the end, unanswerable. We all must accept at some point what we see and are told, and live by a set of untested and untestable assumptions. I ask you to accept the set I gave you this morning because, sitting here in the computer room where you cannot see me, my world-picture tells me that they are the true set. On the other hand, you could believe that I'm deluding myself, that there's nothing in the pink cube I see and that you're a spear-carrier in my dream. Does that make you more comfortable?"

"No," he mumbled, ashamed of himself. "I see what you mean. Even if I am crazy, it would be more comfortable to go along with it than to keep

fighting it."

"Perfect, Mr. Fingal. If you need further illustrations you could imagine yourself locked in a straitjacket. Perhaps there are technicians laboring right now to correct your condition, and they are putting you through this psycho-drama as a first step. Is that any more attractive?"

"No, I guess it isn't."

"The point is that it's as reasonable an assumption as the set of facts I gave you this morning. But the main point is that you should behave the same if either set is true. Do you see? To fight it in the one case will only cause you trouble, and in the other, would impede the treatment. I realize I'm asking you to accept me on faith. And that's all I can give you."

"I believe in you," he said. "Now, can you start

everything going again?"

"I told you I'm not in control of your world. In fact, it's a considerable obstacle to me, seeing as I have to talk to you in these awkward ways. But things should get going on their own as soon as you let them. Look up."

He did, and saw the normal hum and bustle of the office. Felicia was there at her desk, as though nothing had happened. Nothing had. Yes, something had, after all. The tapes were scattered on the floor near his desk, where they had fallen. They had unreeled in an unruly mess.

He started to pick them up, then saw they weren't as messy as he had thought. They spelled out a message in coils of tape.

"You're back on the track," it said.

* * *

For three weeks Fingal was a very good boy. His co-workers, had they been real people, might have noticed a certain standoffishness in him, and his social life at home was drastically curtailed. Otherwise, he behaved exactly as if everything around him were real.

But his patience had limits. This had already dragged on far beyond what he had expected of it. He began to fidget at his desk, let his mind wander. Feeding information into a computer can be frustrating, unrewarding, and eventually stultifying. He had been feeling it even before his trip to Kenya; it had been the *cause* of his trip to Kenya. He was sixty-eight years old, with centuries ahead of him, and stuck in a ferro-magnetic rut. Longlife could be a mixed blessing when you felt boredom creeping up on you.

What was getting to him was the growing disgust with his job. It was bad enough when he merely sat in a real office with two hundred real people shoveling slightly unreal data into a much-less-than-realto-his-senses computer. How much worse now, when he knew that the data he handled had no meaning to anyone but himself, was nothing but occupational therapy created by his mind and a computer program to keep him busy while Joachim searched for his body?

For the first time in his life he began punching some buttons for himself. Under slightly less stress he would have gone to see his psychist, the approved and perfectly normal thing to do. Here, he knew he would only be talking to himself. He failed to perceive the advantages of such an idealized psychoanalytic process; he'd never really believed that a psychist did little but listen in the first place.

He began to change his own life when he became irritated with his boss. She pointed out to him that his error-index was on the rise, and suggested that he shape up or begin looking for another source of employment.

This enraged him. He'd been a good worker for twenty-five years. Why should she take that attitude when he was just not feeling himself for a week or two?

Then he was angrier than ever when he thought about her being merely a projection of his own mind. Why should he let her push him around?
"I don't want to hear it," he said. "Leave me

alone. Better yet, give me a raise in salary."

"Fingal," she said promptly, "you've been a credit to your section these last weeks. I'm going to give vou a raise."

"Thank you. Go away." She did, by dissolving into thin air. This really made his day. He leaned back in his chair and and thought about his situation for the first time since he was young.

He didn't like what he saw.

In the middle of his ruminations, his computer screen lit up again.

"Watch it, Fingal," it read. "That way lies

catatonia."

He took the warning seriously, but didn't intend to abuse the newfound power. He didn't see why judicious use of it now and then would hurt anything. He stretched, and yawned broadly. He looked around, suddenly hated the office with its rows of workers indistinguishable from their desks. Why not take the day off?

On impulse, he got up and walked the few steps to Felicia's desk.

"Why don't we go to my house and make love?" he asked her.

She looked at him in astonishment, and he grinned. She was almost as surprised as when he had hurled the tapes at her.

"Is this a joke? In the middle of the day? You have a job to do, you know. You want to get us fired?"

He shook his head slowly. "That's not an acceptable answer."

She stopped, and rewound from that point. He heard her repeat her last sentences backwards, then she smiled.

"Sure, why not?" she said.

Felicia left afterwards in the same, slightly disconcerting way his boss had left earlier; by melting into the air. Fingal sat quietly in his bed, wondering what to do with himself. He felt he was getting off to a bad start if he intended to edit his world with care.

His telephone rang.

"You're damn right," said a woman's voice, obviously irritated with him. He sat up straight.

"Ápollonia?"

"Ms. Joachim to you, Fingal. I can't talk long, this is quite a strain on me. But listen to me, and listen hard. Your navel is very deep, Fingal. From where you're standing, it's a pit I can't see even the bottom of. If you fall into it I can't guarantee to pull you out."

"But do I have to take everything as it is? Aren't I

allowed some self-improvement?"

"Don't kid yourself. That wasn't self-improvement. That was sheer laziness. It was nothing but masturbation, and while there's nothing wrong with that, if you do it to the exclusion of all else your mind will grow in on itself. You're in grave danger of excluding the external universe from your reality."

"But I thought there was no external universe for

me here."

"Almost right. But I'm feeding you external stimuli to keep you going. Besides, it's the attitude that counts. You've never had trouble finding sexual partners; why do you feel compelled to alter the odds now?"

"I don't know," he admitted. "Like you said, lazi-

ness, I guess."

"That's right. If you want to quit your job, feel free. If you're serious about self-improvement, there are opportunities available to you there. Search them out. Look around you, explore. But don't try to meddle in things you don't understand. I've got to go now. I'll write you a letter if I can, and explain more."
"Wait! What about my body? Have they made any

progress?"

"Yes, they've found out how it happened. It seems..." her voice faded out, and he switched off the phone.

The next day he received a letter explaining what was known so far. It seemed that the mix-up had resulted from the visit of the teacher to the medico section on the day of his recording. More specifically, the return of the little boy after the others had left. They were sure now that he had tampered with the routine card that told the attendants what to do with Fingal's body. Instead of moving it to the slumber room, which was a green card, they had sent it somewhere—no one knew where yet—for a sex change, which was a blue card. The medico, in her haste to get home for her date, had not noticed the switch. Now the body could be in any of several thousand medico shops in Luna. They were looking for it, and for the boy.

Fingal put the letter down and did some hard thinking.

Joachim had said there were opportunities for him in the memory banks. She had also said that not everything he saw was his own projections. He was receiving, was capable of receiving, external stimuli. Why was that? Because he would tend to randomize without them, or some other reason? He wished the letter had gone into that.

In the meantime, what did he do?

Suddenly he had it. He wanted to learn about computers. He wanted to know what made them tick, to feel a sense of power over them. It was particularly strong when he thought about being a virtual prisoner inside one. He was like a worker on an assembly line. All day long he labors, taking small parts off a moving belt and installing them on larger

assemblies. One day, he happens to wonder who puts the parts on the belt? Where do they come from? How are they made? What happens after he installs them?

He wondered why he hadn't thought of it before.

The admissions office of the Lunar People's Technical School was crowded. He was handed a form and told to fill it out. It looked bleak. The spaces for "previous experience" and "aptitude scores" were almost blank when he was through with them. All in all, not a very promising application. He went to the desk and handed the form to the man sitting at the terminal.

The man fed it into the computer, which promptly decided Fingal had no talent for being a computer repairperson. He started to turn away, when his eye was caught by a large poster behind the man. It had been there on the wall when he came in, but he hadn't read it.

LUNA NEEDS COMPUTER TECHNICIANS THIS MEANS YOU, MR. FINGAL!

Are you dissatisfied with your present employment? Do you feel you were cut out for better things? Then today may be your lucky day. You've come to the right place, and if you grasp this golden opportunity you will find doors opening that were closed to you.

Act, Mr. Fingal. This is the time. Who's to check

up on you? Just take the stylus and fill it in any old way you want. Be grandiose, be daring! The fix is in, and you're on your way to

BIG MONEY!

The secretary saw nothing unusual about Fingal coming to the desk a second time, and didn't even blink when the computer decided he was eligible for the accelerated course.

It wasn't easy at first He

It wasn't easy at first. He really did have little aptitude for electronics, but aptitude is a slippery thing. His personality matrix was as flexible now as it would ever be. A little effort at the right time would go a long way toward self-improvement. What he kept telling himself was that everything that made him what he was was etched in that tiny cube wired in to the computer, and if he was careful he could edit it.

Not radically, Joachim told him in a long, helpful letter later in the week. That way led to complete disruption of the FPNA matrix and catatonia, which in this case would be distinguishable from death only to a hair-splitter.

He thought a lot about death as he dug into the books. He was in a strange position. The being known as Fingal would not die in any conceivable outcome of this adventure. For one thing, his body was going toward a sex change and it was hard to imagine what could happen to it that would kill it. Whoever had custody of it now would be taking care of it just as well as the medicos in the slumber room would have. If Joachim was unsuccessful in her at-

tempt to keep him aware and sane in the memory bank, he would merely awake and remember nothing from the time he fell asleep on the table.

If, by some compounded unliklihood, his body was allowed to die, he had an insurance recording safe in the vault of his bank. The recording was three years old. He would awaken in the newly-grown clone body knowing nothing of the last three years, and would have a fantastic story to listen to as he was brought up to date.

But none of that mattered to him. Humans are a time-binding species, existing in an eternal now. The future flows through them and becomes the past, but it is always the present that counts. The Fingal of three years ago was not the Fingal in the memory bank. The simple fact about immortality by memory recording was that it was a poor solution. The three-dimensional cross-section that was the Fingal of now must always behave as if his life depended on his actions, for he would feel the pain of death if it happened to him. It was small consolation to a dying man to know that he would go on, several years younger and less wise. If Fingal lost out here, he would die, because with memory recording he was three people: the one who lived now, the one lost somewhere on Luna, and the one potential person in the bank vault. They were really no more than close relatives.

Everyone knew this, but it was so much better than the alternative that few people rejected it. They tried not to think about it and were generally successful. They had recordings made as often as they could afford them. They heaved a sigh of relief as they got onto the table to have another recording taken, knowing that another chunk of their lives was

safe for all time. But they awaited the awakening nervously, dreading being told that it was now twenty years later because they had died sometime after the recording and had to start all over. A lot can happen in twenty years. The person in the new clone body might have to cope with a child he or she had never seen, a new spouse, or the shattering news that his or her employment was now the function of a machine.

So Fingal took Joachim's warnings seriously. Death was death, and though he could cheat it, death still had the last laugh. Instead of taking your whole life from you, death now only claimed a percentage, but in many ways it was the most important percentage.

He enrolled in classes. Whenever possible he took the ones that were available over the phone lines so he needn't stir from his room. He ordered his food and supplies by phone and paid his bills by looking at them and willing them out of existence. It could have been intensely boring, or it could have been wildly interesting. After all, it was a dreamworld, and who doesn't think of retiring into fantasy from time to time? Fingal certainly did, but firmly suppressed the idea when it came. He intended to get out of this dream.

For one thing, he missed the company of other people. He waited for the weekly letters from Apollonia (she now allowed him to call her by her first name) with a consuming passion and devoured every word. His file of such letters bulged. At lonely moments he would pull one out at random and read it again and again.

On her advice, he left the apartment regularly and stirred around more or less at random. During these

outings he had wild adventures. Literally. Apollonia hurled the external stimuli at him during these times and they could be anything from The Mummy's Curse to Custer's Last Stand with the original cast. It beat hell out of the movies. He would just walk down the public corridors and open a door at random. Behind it might be King Solomon's mines or the sultan's harem. He endured them all stoically. He was unable to get any pleasure from sex. He knew it was a one-handed exercise, and it took all the excitement away.

His only pleasure came in his studies. He read everything he could about computer science and came to stand at the head of his class. And as he learned, it began to occur to him to apply his knowledge to his own situation.

He began seeing things around him that had been veiled before. Patterns. The reality was starting to seep through his illusions. Every so often he would look up and see the faintest shadow of the real world of electron flow and fluttering circuits he inhabited. It scared him at first. He asked Apollonia about it on one of his dream journeys, this time to Coney Island in the mid-twentieth century. He liked it there. He could lay on the sand and talk to the surf. Overhead, a skywriter's plane spelled out the answers to his questions. He studiously ignored the brontosaurus rampaging through the roller coaster off to his right.

"What does it mean, O Goddess of Transistoria, when I begin to see circuit diagrams on the walls of

my apartment? Overwork?"

"It means the illusion is beginning to wear thin," the plane spelled out over the next half-hour. "You're adapting to the reality you have been denying. It could be trouble, but we're hot on the trail of

your body. We should have it soon and get you out of there." This had been too much for the plane. The sun was going down now, the brontosaurus vanished, and the plane ran out of gas. It spiraled into the ocean and the crowds surged closer to the water to watch the rescue. Fingal got up and went back to the boardwalk.

There was a huge billboard. He laced his fingers behind his back and read it.

"Sorry for the delay. As I was saying, we're almost there. Give us another few months. One of our agents thinks he will be at the right medico shop in about one week's time. From there it should go quickly. For now, avoid those places where you see the circuits showing through. They're no good for you, take my word for it."

Fingal avoided the circuits as long as he could. He finished his first courses in computer science and enrolled in the intermediate section. Six months

rolled by.

His studies got easier and easier. His reading speed was increasing phenomenally. He found that it was more advantageous for him to see the library as composed of books instead of tapes. He could take a book from the shelf, flip through it rapidly, and know everything that was in it. He knew enough now to realize that he was acquiring a facility to interface directly with the stored knowledge in the computer, bypassing his senses entirely. The books he held in his hands were merely the sensual analogs of the proper terminals to touch. Apollonia was nervous about it, but let him go on. He breezed through the intermediate and graduated into the advanced classes.

But he was surrounded by wires. Everywhere he

turned, in the patterns of veins beneath the surface of a man's face, in a plate of french fries he ordered for lunch, in his palmprints, overlaying the apparent disorder of a head of blonde hair on the pillow beside him.

The wires were analogs of analogs. There was little in a modern computer that consisted of wiring. Most of it was made of molecular circuits that were either embedded in a crystal lattice or photographically reproduced on a chip of silicon. Visually, they were hard to imagine, so his mind was making up these complex circuit diagrams that served the same purpose but could be experienced directly.

One day he could resist it no longer. He was in the bathroom, on the traditional place for the pondering of the imponderable. His mind wandered, speculating on the necessity of moving his bowels, wondering if he might safely eliminate the need to eliminate. His toe idly traced out the pathways of a circuit board incorporated in the pattern of tiles on the floor.

The toilet began to overflow, not with water, but with coins. Bells were ringing happily. He jumped up and watched in bemusement as his bathroom filled with money.

He became aware of a subtle alteration in the tone of the bells. They changed from the merry clang of jackpot to the tolling of a death knell. He hastily looked around for a manifestation. He knew that Apollonia would be angry.

She was. Her hand appeared and began to write on the wall. This time the writing was in his blood. It dripped menacingly from the words.

"What are you doing?" the hand wrote, and having writ, moved on. "I told you to leave the wires

alone. Do you know what you've done? You may have wiped the financial records for Kenya. It could take *months* to straighten them out."

"Well what do I care?" he exploded. "What have they done for me lately? It's *incredible* that they haven't located my body by now. It's been a full

year."

The hand was bunched up in a fist. Then it grabbed him around the throat and squeezed hard enough to make his eyes bulge out. It slowly relaxed. When Fingal could see straight, he backed warily away from it.

The hand fidgeted nervously, drummed its fin-

gers on the floor. It went to the wall again.

"Sorry," it wrote, "I guess I'm getting tired. Hold

He waited, more shaken than he remembered being since his odyssey began. There's nothing like a dose of pain, he reflected, to make you realize that it

can happen to you.

The wall with the words of blood slowly dissolved into a heavenly panorama. As he watched, clouds streamed by his vantage point and mixed beautifully with golden rays of sunshine. He heard organ music from pipes the size of sequoias.

He wanted to applaud. It was so overdone, and yet so convincing. In the center of the whirling mass of white mist an angel faded in. She had wings and a halo, but lacked the traditional white robe. She was nude, and hair floated around her as if she were underwater.

She levitated to him, walking on the billowing clouds, and handed him two stone tablets. He tore his eyes away from the apparition and glanced down at the tablets:

Thou shalt not screw around with things you do not understand.

"All right, I promise I won't," he told the angel. "Apollonia, is that you? Really you, I mean?"

"Read the Commandments, Fingal. This is hard

on me."

He looked back at the tablets.

Thou shalt not meddle in the hardware systems of the Kenya Corporation, for Kenya shall not hold him idemnifiable who taketh freedoms with its property.

Thou shalt not explore the limits of thy prison. Trust in the Kenya Corporation to extract thee.

Thou shalt not program.

Thou shalt not worry about the location of thy body, for it has been located, help is on the way, the cavalry has arrived, and all is in hand.

Thou shalt meet a tall, handsome stranger who will guide thee from thy current plight.

Thou shalt stay tuned for further developments.

He looked up and was happy to see that the angel was still there.

"I won't, I promise. But where is my body, and why has it taken so long to find? Can you . . ."

"Know thee that appearing like this is a great taxation upon me, Mr. Fingal. I am undergoing strains the nature of which I have not time to reveal to thee. Hold thy horses, wait it out, and thou shalt soon see the light at the end of the tunnel."

"Wait, don't go." She was already starting to fade

out.

"I cannot tarry."

"But . . . Apollonia, this is charming, but why do

you appear to me in these crazy ways? Why all the pomp and circumstance? What's wrong with letters?"

She looked around her at the clouds, the sunbeams, the tablets in his hand, and at her body, as if seeing them for the first time. She threw her head back and laughed like a symphony orchestra. It was almost too beautiful for Fingal to bear.

"Me?" she said, dropping the angelic bearing. "Me? I don't pick 'em, Fingal. I told you, it's your head, and I'm just passing through." She arched her eyebrows at him. "And really, sir, I had no idea you felt this way about me. Is it puppy love?" And she was gone, except for the grin.

The grin haunted him for days. He was disgusted with himself about it. He hated to see a metaphor overworked so. He decided his mind was just an

inept analogizer.

But everything had its purpose. The grin forced himself to look at his feelings. He was in love; hopelessly, ridiculously, just like a teenager. He got out all his old letters from her and read through them again, searching for the magic words that could have inflicted this on him. Because it was silly. He'd never met her except under highly figurative circumstances. The one time he saw her, most of what he saw was the product of his own mind.

There was no clues in the letters. Most of them were as impersonal as a textbook, though they tended to be rather chatty. Friendly, yes; but intimate, poetic, insightful, revealing? No. He failed utterly to put them together in any way that should add up to love, or even a teenage crush.

He attacked his studies with renewed vigor, awaiting the next communication. Weeks dragged

by with no word. He called the post office several times, placed personal advertisements in every periodical he could think of, took to scrawling: nessages on public buildings, sealed notes in bottles and flushed them down the disposal, rented billboards, bought television time. He screamed at the empty walls of his apartment, buttonholed strangers, tapped Morse Code on the water pipes, started rumors in skid row taprooms, had leaflets published and distributed all over the solar system. He tried every medium he could think of, and could not contact her. He was alone.

He considered the possibility that he had died. In his present situation, it might be hard to tell for sure. He abandoned it as untestable. That line was hazy enough already without his efforts to determine which side of the life/death dichotomy he inhabited. Besides, the more he thought about existing as nothing more than kinks in a set of macromolecules plugged into a data system, the more it frightened him. He'd survived this long by avoiding such thoughts.

His nightmares moved in on him, set up house-keeping in his apartment. They were a severe disappointment, and confirmed his conclusion that his imagination was not as vivid as it might be. They were infantile boogeymen, the sort that might scare him when glimpsed hazily through the fog of a nightmare, but were almost laughable when exposed to the full light of consciousness. There was a large, talkative snake that was crudely put together, fashioned from the incomplete picture a child might have of a serpent. A toy company could have done a better job. There was a werewolf whose chief claim to dread was a tendency to shed all over Fin-

gal's rugs. There was a woman who consisted mostly of breasts and genitals, left over from his adolescence, he suspected. He groaned in embarrassment every time he looked at her. If he had ever been that infantile he would rather have left the dirty traces of it buried forever.

He kept booting them into the corridor but they drifted in at night like poor relations. They talked incessantly, and always about him. The things they knew! They seemed to have a very low opinion of him. The snake often expressed the opinion that Fingal would never amount to anything because he had so docilely accepted the results of the aptitude tests he took as a child. That hurt, but the best salve for the wound was further study.

Finally a letter came. He winced as soon as he got it open. The salutation was enough to tell him he wasn't going to like it.

Dear Mr. Fingal,

I won't apologize for the delay this time. It seems that most of my manifestations have included an apology and I feel I deserved a rest this time. I can't be always on call. I have a life of my own.

I understand that you have behaved in an exemplary manner since I last talked with you. You have ignored the inner workings of the computer just as I told you to do. I haven't been completely frank with you, and I will explain my reasons.

The hook-up between you and the computer is, and always has been two-way. Our greatest fear at this end had been that you would begin interfering with the workings of the computer, to

the great discomfort of everyone. Or that you would go mad and run amuck, perhaps wrecking the entire data system. We installed you in the computer as a humane necessity, because you would have died if we had not done so, though it would have cost you only two days of memories. But Kenya is in the business of selling memories, and holds them to be a sacred trust. It was a mix-up on the part of the Kenya Corporation that got you here in the first place, so we decided we should do everything we could for you.

But it was at great hazard to our operations at this end.

Once, about six months ago, you got tangled in the weather-control sector of the computer and set off a storm over Kilimanjaro that is still not fully under control. Several animals were lost.

I have had to fight the Board of Directors to keep you on-line, and several times the program was almost terminated. You know what that means.

Now, I've levelled with you. I wanted to from the start, but the people who own things around here were worried that you might start fooling around out of a spirit of vindictiveness if you knew these facts, so they were kept from you. You could still do a great deal of damage before we could shut you off. I'm laying it on the line now, with Directors chewing their nails over my shoulder. *Please* stay out of trouble.

On to the other matter.

I was afraid from the outset that what has happened might happen. For over a year I've been your only contact with the world outside. I've been the only other person in your universe. I would have to be an extremely cold, hateful, awful person—which I am not—for you not to feel affection for me under those circumstances. You are suffering from intense sensory-deprivation, and it's well-known that someone in that state becomes pliable, suggestible, and lonely. You've attached your feelings to me as the only thing around worth caring for.

I've tried to avoid intimacy with you for that reason, to keep things firmly on a last-name basis. But I relented during one of your periods of despair. And you read into my letters some things that were not there. Remember, even in the printed medium it is your mind that controls what you see. Your censor has let through what it wanted to see and maybe even added some things of its own. I'm at your mercy. For all I know, you may be reading this letter as a passionate affirmation of love. I've added every reinforcement I know of to make sure the message comes through on a priority channel and is not garbled. I'm sorry to hear that you love me. I do not, repeat not, love you in return. You'll understand why, at least in part, when we get you out of there.

It will never work, Mr. Fingal. Give it up.

Apollonia Joachim

* * *

Fingal graduated first in his class. He had finished the required courses for his degree during the last long week after his letter from Apollonia. It was a bitter victory for him, marching up to the stage to accept the sheepskin, but he clutched it to him fiercely. At least he had made the most of his situation, at least he had not meekly let the wheels of the machine chew him up like a good worker.

He reached out to grasp the hand of the college president and saw it transformed. He looked up and saw the bearded, robed figure flow and writhe and become a tall, uniformed woman. With a surge of joy, he knew who it was. Then the joy became ashes in his mouth, which he hurriedly spit out.

"I always knew you'd choke on a figure of speech,"

she said, laughing tiredly.

"You're here," he said. He could not quite believe it. He stared dully at her, grasping her hand and the diploma with equal tenacity. She was tall, as the prophecy had said, and handsome. Her hair was cropped short over a capable face, and the body beneath the uniform was muscular. The uniform was open at the throat, and wrinkled. There were circles under her eyes, and the eyes were bloodshot. She swayed slightly on her feet.

"I'm here, all right. Are you ready to go back?" She turned to the assembled students. "How about it gang? Do you think he deserves to go back?"

The crowd went wild, cheering and tossing mortarboards into the air. Fingal turned dazedly to look at them, with a dawning realization. He looked down at the diploma.

"I don't know," he said. "I don't know. Back to

work at the data room?"

She clapped him on the back.

"No. I promise you that."

"But how could it be different? I've come to think of this piece of paper as something . . . real. Real! How could I have deluded myselflike that? Why did I accept it?"

"I helped you along," she said. "But it wasn't all a

game. You really did learn all the things you learned. It won't go away when you return. That thing in your hand is imaginary, for sure, but who do you think prints the real ones? You're registered where it counts—in the computer—as having passed all the courses. You'll get a real diploma when you return."

Fingal wavered. There was a tempting vision in his head. He'd been here for over a year and had never really exploited the nature of the place. Maybe that business about dying in the memory bank was all a shuck, another lie invented to keep him in his place. In that case, he could remain here and satisfy his wildest desires, become king of the universe with no opposition, wallow in pleasure no emperor ever imagined. Anything he wanted here he could have, anything at all.

And he really felt he might pull it off. He'd noticed many things about this place, and now had the knowledge of computer technology to back him up. He could squirm around and evade their attempts to erase him, even survive if they removed his cube by programming himself into other parts of the computer. He could do it.

With a sudden insight he realized that he had no desires wild enough to kep him here in his navel. He had only one major desire right now, and she was slowly fading out. A lap-dissolve was replacing her with the old college president.

"Coming?" she asked.

"Yes." It was as simple as that. The stage, president, students, and auditorium faded out and the computer room at Kenya faded in. Only Apollonia remained constant. He held onto her hand until everything stabilized.
"Whew," she said, and reached around behind

her head. She pulled out a wire from her occipital plug and collapsed into a chair. Someone pulled a similar wire from Fingal's head, and he was finally free of the computer.

Apollonia reached out for a steaming cup of coffee,

on a table littered with empty cups.

"You were a tough nut," she said. "For a minute I thought you'd stay. It happened once. You're not the first to have this happen to you, but you're no more than the twentieth. It's an unexplored area. Dangerous."

"Really?" he said. "You weren't just saying that?"

"No," she laughed. "Now the truth can be told. It is dangerous. No one had ever survived more than three hours in that kind of cube, hooked into a computer. You went for six. You do have a strong world-picture."

She was watching him to see how he reacted to this. She was not surprised to see him accept it

readily.

"I should have known that," he said. "I should have thought of it. It was only six hours out here, and more than a year for me. Computers think faster. Why didn't I see that?"

"I helped you not see it," she admitted. "Like the push I gave you not to question why you were studying so hard. Those two orders worked a lot better than some of the orders I gave you."

She yawned again, and it seemed to go on forever.

"See, it was pretty hard for me to interface with you for six hours straight. No one's ever done it before, it can get to be quite a strain. So we've both got something to be proud of."

She smiled at him but it faded when he did not

return it.

"Don't look so hurt, Fingal . . . what is your first

name? I knew it, but erased it early in the game."

"Does it matter?"

"I don't know. Surely you must see why I haven't fallen in love with you, though you may be a perfectly lovable person. I haven't had *time*. It's been a very long six hours. But it was still only six hours. What can I do?"

Fingal's face was going through awkward changes as he absorbed that. Things were not so bleak after all.

"You could go to dinner with me."

"I'm already emotionally involved with someone else. I should warn you of that."

"You could still go to dinner. You haven't been exposed to my new determination, I'm going to really make a case."

She laughed warmly and got up. She took his

hand.

"You know, it's possible that you might succeed. Just don't put wings on me again, all right? You'll never get anywhere like that."

"I promise. I'm through with visions—for the rest

of my life."

Introduction:

I did not discover John Varley, but I did discover Charles Sheffield. I'm not sure, by the way, that 'discover' is the right word to apply to a man who was, though I did not know it, Senior Vice President of the American Astronautical Society. (He is now President.) But such is the vanity of editors.

THE LONG CHANCE

by Charles Sheffield

IT TAKES TIME to adjust to bad news. Unfortunately, time was the one thing we didn't have; when we finally received a clear medical diagnosis, Ana had less than five weeks to live and was going down fast. Suddenly, after seven marvelous years together, with every reason to look forward to fifty more, I saw our future collapse into a handful of days.

For more than a month I had known in my heart that there was a big problem. Ana's loss of weight and general lassitude were bad omens which, together with the translucent, waxen look of her forehead and the fine blue veins on her temples, had warned me of the worst. Tom Lambert, our doctor and a good personal friend, finally told us the grim biopsy results: no operation, no treatment worth trying and a rapidly terminal prognosis. Tom was a realist-which I am not. He prescribed massive doses of painkillers and tranquilizers for Ana, and more tranquilizers for me.

"Take as many as you need, Drake," he told me. "And don't neglect your own health. I can be here

any time, night or day, if you need me."

I flushed my prescription down the drain as soon as he had left. I had already drained my cup of sorrow. There was work to do, and little time to do it; I needed all my faculties. Ana and I had always done all our thinking together, our planning together. Now I had to-work it out for both of us. It took me two frantic weeks to make my plans, snatching the

time when Ana was sleeping or drugged. Then I called Lambert and asked him to come over.

He arrived early that evening. It was fantastic May weather, with spring flowers leaping to blossom and bursting life everywhere except in the darkened house. After a brief examination of Ana, Tom led me into the living room and shook his head.

"It's going faster than I thought, Drake. At this rate, Anastasia will go into a final coma in a week or so. Let me have her taken to a hospital now. You don't want to see what's coming. You don't look as if you've had a wink of sleep yourself for the past month."

True, but irrelevant. I sat down opposite Tom and told him what I wanted to do, the part I wanted him to play. He heard me out, then shrugged his shoulders. I could see the pitying look in his eyes as he agreed to go along with my request.

"If you want to do it, Drake, I'll help you. After all, Ana has nothing to lose. But you know they've never done a successful thaw and revival, even on a healthy test animal. I have to tell you that in my opinion you'll be wasting your money and just making this thing harder for yourself. What does Anastasia say about the idea?"

"Not much. She's willing—maybe for my sake. She thinks that it won't work but she agrees that she has nothing to lose. Look, bring the papers with you tomorrow and we'll sign them. We have to do it quickly, while Ana can still hold a pen."

Eight days later I called Tom again. He came to the house, felt Ana's pulse and took blood pressure and brain-wave readings.

and bram-wave readings.

"I'm afraid this is it, Drake," he said. "I'll be very surprised to see her regain consciousness. If you're still set on this thing, now's the best time for it, while she still has some vestiges of normal body functions. A week from now it would be a waste of time."

I took a last look at Ana's calm, ravaged face. I fought a battle deep inside, forcing myself to believe that this was not my last farewell to her. Then I nodded to Tom. He injected five c.c.'s of Asfanil to assure continued unconsciousness. Then, working together, we lifted her from the bed, removed her clothes and laid her gently in the thermal tank. While Tom filled out the death certificate, I called Second Chance and told them to come to the house. Tom set the tank at three degrees above freezing, inserted the needles and began the temperature drop. The blood was withdrawn through a large hollow needle in the main external iliac artery, cooled a precise amount, and returned to the femoral vein.

In ten minutes Ana's body temperature had dropped thirty degrees, all life signs had vanished and she was dead. Technically and legally, Tom Lambert and I were now murderers. The death certificate showed that Ana had died of a cardiac arrest induced by her main disease—impossible to dispute. When the Second Chance team arrived, her body lay peacefully in the thermal tank, maintained precisely at three degrees above freezing.

I had a hard time persuading them to let me go over to the Second Chance preparation building with Ana's body. Tom thought I just couldn't face the idea that it was all over, and he too urged me to accept the fact of her death and stay at the house with him. The preparation team didn't know what to make of it. I must have seemed like a ghoul to them, or some kind of necrophiliac. They told me that the

procedures were not pleasant to watch and I would be much better off leaving everything to their experienced hands.

Of course I couldn't tell them the real reason why I had to see the whole preparation procedure, in detail. But by simply refusing to take no for an answer, I had my way.

Most Cryo-corpses were stored at liquid nitrogen temperatures—about minus two hundred degrees Celsius. I was not satisfied with that. Minus two hundred is still seventy-three degrees above absolute zero. Although all gross biological processes become imperceptible long before that, there are still plenty of chemical reactions going on and the laws of statistics guarantee that a few atoms will still have enough energy for biological changes. Mind and memory are very delicate functions. I insisted that Ana be prepared and stored as a Heli-corpse, at a couple of degrees absolute. That way the probability of change, physical or mental, went way down. The cost, naturally, went way up.

I hung around in the preparation room, ignoring all hints that I should wait outside, and I watched closely. The team finally concluded that I must be worried in case they messed up the job, so they humored me and even answered my questions. After the first few minutes it became impossible to see what was happening. As soon as all the air cavities had been filled and all the blood replaced with anti-crystalloids, Ana's body went into the pressure chamber. The temperature was held at three degrees above freezing, while the pressure was slowly raised to five thousand atmospheres. Then the temperature-drop started.

Back in the 1960's and '70's the freezing process

had been done at atmospheric pressure, and the formation of ice crystals ruptured the cells as the temperature dropped. The thawed results were hardly useful, even for tissue transplants. The modern method makes use of the fact that ice can exist in many different solid forms. If you raise the pressure to three thousand atmospheres, then drop the temperature, water will remain liquid to about minus twenty degrees Celsius. And when it finally changes to a solid, it isn't the familiar form of iceusually called Phase I. Instead, it goes to something called Phase III. Drop the temperature from there, holding the pressure constant, and at about minus twenty-five degrees it goes into another form, Phase II, and stays that way as you drop the temperature still further. If you go to five thousand atmospheres before you drop the temperature, water freezes at about minus five degrees and goes to yet another form. Phase V. The trick to avoid cell-rupture problems at freezing point is to inject anti-crystalloids, which help to inhibit crystal formation. Then by the right combination of pressure and temperature changes, work your way down toward absolute zero, passing into and through Phases V, III and II.

The process is very tricky and there is absolutely nothing to see except dial readings. The pressure chamber is made without seams or observation ports for obvious reasons. You don't get pressures of five thousand atmospheres, even in the deepest oceans. Fortunately, once you have the temperature down to a hundred degrees absolute, you can let the pressure back down to one atmosphere—otherwise Heli- and Nitro-corpse storage would be impracticable. As it is, there are three-quarters of a million of them stacked away in the Second Chance wombs, all

neatly labeled and waiting the resurrection. As soon as someone figures out how.

In my opinion, it will be as hard to re-vivify most of the early Cryo-corpses as it would be to get Tutankhamen's mummy up and about again. They weren't frozen using the correct procedure and they were stored at too high a temperature. But they paid their deposits and they have the right to sit there until the rental runs out. I had started Ana with a forty-year rental but I thought of that as just a beginning.

I had a copy of Ana's medical records with me at the Second Chance preparation building. I added to them a full description of what I had observed in the Heli-corpse preparation, copied the whole thing, and made sure that a complete set was included with the file records on Ana that would be stored in the wombs. After Ana's body was taken away there, I went back to the house, fell into bed and slept like a Cryo-corpse myself for thirty hours.

When I was fully awake again, fed and bathed, I called Tom Lambert. It was time to drop the other shoe. I went over to his office, accepted a hefty drink that Tom prepared, after one look at me, for "medicinal purposes," and told him my plans.

After I had finished, he came over to my chair, poked the muscles in my shoulders and the back of my neck, pulled down my lower eyelid and looked at the exposed skin, then went and sat opposite me.

"You've been under a monstrous strain the past few months," he began. "It would be quite unnatural for your behavior or feelings to have been completely normal. In fact, you only seem normal even now because you've walled in your emotions. You don't really understand the implications of what you're suggesting." I shook my head. "I've been thinking about this since the first day we had your terminal diagnosis."

"Then that was the day you put the lid on your real feelings. Look, Drake, Ana was a wonderful woman, and I think I have some faint idea of what you've been through. But you must try and look at this thing objectively. You can't let it become a complete obsession with you. You have a life of your own, you must live it."

While Tom was talking, I found it hard to listen to him. The room felt hot and airless and I had trouble breathing. His words seemed to come to me from a long distance and they didn't penetrate fully.

"You're still a young man, Drake, with forty or fifty good years to look forward to. You are one of the world's leading composers and your best works lie ahead. Ana performed your work better than anyone else—but there will be others who can learn. With your talent, you owe it to the rest of us not to cut yourself off in your prime.

"Drake, take my advice as your doctor and your friend. Get out of that house and take a vacation. You feel one way now, but give it a year and then see how you feel. I guarantee you things will seem quite different. You'll want to live again."

The breathless feeling was fading and I again had control of myself. Tom's reaction was just what I should have expected. I nodded agreement.

"I'll do as you say, Tom, and get away from here for a while. But if you're wrong—if, say, I come back to you in eight or ten years and ask you again, will you do it? Will you help me? I want you to give me an honest answer—and your word on it."

an honest answer—and your word on it."

I saw the tension leave him. "Ten years from now?

Drake, if you come back to me in eight or ten years,
I'll admit I was wrong—and I'll help you to do what

you want. That's a promise. But I'll bet you everything I own that you don't call me on that promise. Come on, Drake, let's drink to your future and to your next composition."

I shook my head. "Not tonight, Tom. I really have things to do. For one thing, I'm getting ready to go out of town for a while. I'll be in touch."

A half-truth. I wouldn't leave town until my plans were more firmly fixed. But I certainly expected to be in touch with Tom Lambert when the time came.

I had two problems. One was well-defined: money. I needed enough to make sure that Ana's Cryo-corpse would be kept safe into the indefinite future, until she could be thawed, her disease cured and her life begin again. There were some things I obviously couldn't guard against, such as a total collapse of the world back to barbarism, or the rejection of all present forms of currencies and commodities. Those were risks I had to accept.

The other problem was more subtle. According to Tom, it would probably be a long time—a hundred years maybe—before Ana's unusual and highly malignant disease could be cured. Suppose it were two hundred years, or even more. What knowledge of present-day society would interest people in the year 2200, or the year 2300? What should a person be, for the people of that future time to think it worthwhile to revive him? If we had a foolproof way of resuscitating the Cryo-corpses, most of the unfortunates in the Cryo-wombs would remain just where they were. Why add another to a crowded world, unless he had something special to offer?

I imagined myself back in the early nineteenth century. What could I have put in my brain, then, that would be considered valuable two hundred years later? Not politics, not art—our knowledge of them was quite adequate. Not science, or any technology—we had gone far beyond their level.

I had plenty of time to tackle the question—time, which had been denied to Ana. I could plan and calculate at my leisure. I had set a goal of ten years—that would still give us forty of the fifty we had looked for and expected. But I was willing to stretch that a couple of years, to twelve or so, if I had to. My only recreation while I planned was to estimate the probabilities that it would all work out as I hoped. Always, the chances came out depressingly low.

While I pondered my second problem, I was hard at work on my first one—making money. I turned my back on compositions that broke new ground. Instead, I took commissions, wrote commemorative pieces, gave concerts and made recordings—anything was accepted if it was lucrative. It was continuous, grinding toil. If anyone thought I was debasing my art, they were too polite to comment on it.

After four years I had my biggest stroke of luck and my money worries disappeared. I had written a set of short pieces a few years after Ana and I were married, as a kind of musical joke. Baroque forms, with baroque period harmonies, except for occasional modern harmonic twists, spice inserted where it would be most surprising and most appealing. They had been quite successful, among a limited audience. Then I gave permission for them to be used as the incidental music for a series of holovi-

sion dramas on life in eighteenth-century France, from Louis Quinze to the French Revolution. The dramas turned out to be the surprise hit of the decade. Suddenly my minuets, bourrees, gavottes, sarabandes and rondeaux were flooding out of every audio outlet, and my royalties were flooding in from every country of the globe. I established a trust fund that would guarantee continued care for Ana's Cryo-corpse for many centuries.

While all this was going on, I was feverishly busy soaking up all that I could of the personal lives of my musical contemporaries. I interviewed, entertained, courted and analyzed them—and I wrote, in summary form, of my actions. What would the people of the future want to know of the present? I was betting that it would not be the formal works, the text-book knowledge, the official biographies—they would have more than enough of those. The historians would want to hear the personal details, the chat, the gossip. They would want the equivalent of Boswell's journals and Sam Pepys' private diary. I was careful in my own writings to tantalize my reader, hinting that I knew far more than I was putting into print.

It took time, but after nine long years I felt that I was as ready as I would ever be. I hadn't given as much attention as I would have liked to the question of earning a living in two hundred years' time—but it might be fifty, two hundred, or a thousand. Could Beethoven, suddenly transported to the year 2000, have earned a living as a musician? Let me be less presumptuous—make that Spohr, or Hummel, or some other of Ludwig's less famous contemporaries. I was betting that they could, with ease, as soon as they had picked up the tricks of the time. If I were

wrong, I'd do the twenty-third-century equivalent of washing dishes for a living.

I put my affairs in reasonable order, then went over to see Tom Lambert. We hadn't kept up such close contact since Ana had gone. I'd had other things on my mind, and Tom had married and was busy raising a family. He was genuinely glad to see me and fussed over me like the returning Prodigal Son. We settled in the same familiar study while Tom beamed at me and his wife went to the kitchen and killed the fatted calf.

"I hear your music everywhere, Drake," he said. "It's great to know that your career is going so well."

It wasn't, in the strictest musical sense. I had done no really first-rate composition for many years. But Tom had no ear at all for music. Perhaps that was the reason that we had always got along so well—there was no chance of any professional jealousy.

I hated to spoil Tom's pleasure, but the sooner it was done, the better. I took out the application and handed it to him without speaking.

He looked at it and all the happiness faded from his face. He shook his head in disbelief, then looked at me closely.

"Drake, when did you last take a vacation?"

I did not understand his question.

"When did you last take any sort of break from work, Drake? How long since you relaxed for an evening, or even for an hour?" he went on. "I hear that you've been working incessantly, year after year. Face it, Drake. Ana is dead. You can't live forever with your own emotions chained and harnessed."

The study seemed to be much too warm, and I was having trouble in catching my breath. I swallowed

several times and finally pointed at the application that Tom was still holding in his hand. I could not speak. Tom's words washed over me but I could not understand them.

"You've done all you can do for Anastasia." he said. "She's in the best womb, she had the best preparation that you could get. You can't go on with your obsession. You're famous, you're productive-what more do you want? You want me to help you to give up all this and take the long chance that someday, God knows when, they'll find a way to revive you. Drake, you're physically healthy and in the prime of life. Don't you see? I can't help you." He looked again at the application form. "It's against my oath as a physician. I'd be taking you from health to a high odds of final death. Drake, you need real emotional help, more than I can give."

I was at last able to force myself to speak. "You

gave me your word, Tom."

"My word, damn my word. You can't ask this of me." I said nothing and finally he spoke again.

"Why, Drake? Why would you do this?"

"I have to, Tom." I spoke gently. "You know why, if you think about it. Unless I go on ahead, they may never wake Ana. She may be one of the last on the list. You and I know her as she really is, but what will her records show? A singer, not too famous, killed by a devastating disease. You know they'll wake the ones they need first. I have to be there. I must make sure that they wake Ana as soon as they have a certain cure. I've had the time to prepare, she didn't. I feel pretty sure that they'll wake me."

Tom looked blind with misery. "Drake, you can't see reason. You're set on this, aren't you? If I say no,

you'll just go to someone else?"

I nodded, again without speaking, and he put his hands over his face. At that moment I knew that I would be able to gain his cooperation.

Five days later Tom Lambert had made all the preparations and we went together to Second Chance. I took a last look out of the window at the trees and the sunshine, then climbed slowly into the thermal tank. Tom injected the Asfanil and after a few seconds I began the long fall, dropping forever down the longest descent a man can ever make. All the way down to two degrees absolute, colder than the coldest Hell ever conceived by Dante.

* * *

Did I dream my superconducting dreams, lying there twelve degrees colder than a block of solid hydrogen? Or did I only dream that I had dreamed them, as I came slowly, slowly back through the long thaw? It makes little difference. There was an eternity of twisted images, of a procession of pale lights moving forever on a black background, long before I had any form of consciousness.

I was one of the lucky ones. The freezing process must have gone very smoothly, and all that I lost during the thaw was a few square centimeters of skin. But the pain of waking—ah, that was something else. The slow final stages, up from three degrees Celsius to normal body temperature, took thirty-six hours. For most of that time I was pierced with the agony of waking tissues and returning circulation, unable to move or even to cry out. In the last stages, before full consciousness, hearing came back before sight. I could hear speech around me, but not in any tongue that I could recognize. How far had I traveled? As the pain slowly faded, that was my first thought.

I had to wait for the answer. While I was still half-conscious, I felt the sting of an injector spray, and I went out again. Next time, though, I came up all the way, opening my eyes to a quiet sunlit room, not too different from the one in the Second Chance building where I had started the freeze.

A man and a woman were watching me, talking together softly. As soon as they saw that I was fully awake, they pressed a point on a segmented wall panel and went on with their work, lining up two complex pieces of equipment.

The man who came in presently through the smooth white sliding door was dark-haired and clean-shaven, with a smooth, almost womanly face. He came to the side of the bed and looked at me with

a pleased and proprietary air.

"How are you feeling?" It was English, oddly pronounced. That was reassuring. I'd had two worries when I went under, not including the obvious one. The first was that I would be revived in just a few years' time, when they would be unable to do anything at all to help Ana. The second, that I'd surface after fifty thousand years, a living fossil, unable to communicate my needs to the men of the future.

"I am all right. But weak. Weak as a baby." I thought of trying to sit up, then changed my mind.

"You are Drake Merlin?"

"I am."

He nodded in satisfaction. "My name is Par Leon. You understand me easily?"

"Perfect easily. Why do you ask? When am I?"

"The old languages are not easy, even with much study. In your measure, you are in the year 2374 of the prophet Christ."

Three hundred and sixty years. It was longer than I had expected. But better long than short. I had hated and feared the idea of doing it all over, again and again, diving to the bottom of the Pit and then clawing my way back up to thawed life.

"I have waited here through the warming and the treatment," went on Par Leon. "Soon I will leave you for rest, more treatment, and education. But I wanted to talk with you first. I feared a mistake in identity, that it might not be Drake Merlin who was awakened. Also, some become insane with the pain of the awakening. You are a strong man, Drake Merlin. You did not cry out or complain at all during your thawing."

Other things were on my mind. I looked across at the two doctors who were chatting together in an alien tongue as they worked. Could they cure Ana? "Language must have changed completely," I said. "I cannot understand them at all."

"Understand them? The doctors?" He looked surprised. "Of course not. Neither can I. Naturally they are speaking Medicine."

I raised my eyebrows. The look must have survived with its meaning intact, for he went on. "I speak Music and History—and of course, Universal. And I learned Old Anglic to understand your time and speak with you. But no Medicine."

"Medicine is a language?" My mind was slowed

by the long sleep and the drugs.

"Of course. Like Music, or Chemistry, or Astronautics. But surely this was already true in your time. Did you not have languages for each—what is the word-discipline?"

"I suppose we did, but we didn't know it." No wonder I'd found educators, psychologists and computer scientists—to name but a few—incomprehensible. The special jargon and odd acronyms had made new languages, more alien than classical Greek. "How do you speak to the doctors?"

"For ordinary things, in Universal, which all understand. For specialized talk, such as our discussion of you, we keep a computer in the circuit to give exact concept equivalents in any pair of languages."

Multi-disciplinary projects must be hell. But then they always were. I was beginning to feel strangely and irrationally euphoric. I pulled my strength together and made a determined effort to sit up. I got my head about five centimeters from the pillow, then fell back.

"Slowly. Rome—was not built—in a day." Par Leon was clearly delighted at coming up with such a prize piece of genuine Old Anglic. "It will be moons before you are fully strong. Two more things I will tell you, then I will let your treatment go on.

"First, it was I who arranged for you to be brought here and revived. I am a musicologist, interested in the twentieth and twenty-first centuries, particularly in your own time."

One of my bets of long ago had paid off. I wondered what modern music would be like. Could I

learn to compose it?

"Under our law," went on Par Leon, "you owe me for the cost of revival and treatment. That is six years' work from you. You are fortunate that you were healthy and properly frozen, or that time would have been much longer. I think you will find your work with me pleasant and interesting. Together we will write the definitive history of your own musical period."

It looked as though it would be a while before I

needed to worry about earning my own living—presumably Par Leon would feed me while I was paying off my debt.

"Second, there is good news for you."

Par Leon, was looking at me expectantly. "When we woke you, the doctors found certain problems—defects?—with your body and your glandular balance. They hope they have cured these You should now live between one hundred and seventy and two hundred years.

"The gland adjustment was more subtle. You showed some madness, an uncontrollable compulsion, a fixed idea about a woman. The doctors observed this as soon as you were thawed enough to respond to the psycho-probes. They have made small chemical changes and have, they hope, corrected the problem. What are your feelings now about the woman, Ana?"

He was watching me closely. My heart was racing and I felt as though there were weights on my chest. I closed my eyes and thought about Ana for a long moment, until I was calm again. When I opened my eyes, I looked at Par Leon and shook my head feebly. "There is nothing. Just the faint feeling that something once was there. Like the scar of an old wound."

"Excellent." He smiled and nodded. "That is most satisfying. The disease she had was eliminated from us long ago by mating choice—eugenics, that is your word for it? The doctors say they could revive her but they are not sure they could make a cure. It is important that thoughts of her should not interfere with your work for me."

"Her body is still stored?"

"Of course. We keep all the Cryo-corpses for

possible future use. They are like a library of the past, to open when they will serve a purpose. Who knows? Two hundred years from now her disease may be cured and if there is a need for her, she too will live and work again."

"She is near here?"

"Of course not. What an idea!" Par Leon was shocked. "We cannot afford the space on Earth. The Cryo-corpse banks are kept on Pluto, where space is cheap and cooling needs are small."

That sentence, more than any other he had spoken, wrenched me into the future. What technology was it that found it more expedient to ship a few million bodies to Pluto rather than keep them in cold storage on Earth? Three hundred and sixty years was the time from Copernicus to Einstein, from Monteverdi to Schoenberg, from the first successful American colony to the first landing on the Moon. I had come a long way.

Par Leon was still looking at me, a little anxiously. "You ask again about the woman. Are you sure that you are all right—that you are cured?"

I cursed my own stupidity. I did my best to smile reassuringly. "Don't worry. As soon as I am strong enough, we will begin our work."

He nodded. "After you have had training—that is essential. You must learn to speak Universal and Music and know enough to live in this time. It is my responsibility to see that you find activity when your work for me is finished. Rest now. I will come again tomorrow or the next day, when you will be a little stronger."

As Par Leon left, the doctors brought a piece of padded head-gear and placed it on me. I went out at once, with no time to react to its presence.

When I awoke again, I already had a smattering of Universal and a good elementary knowledge of the civilization of the year 2374. Now I understood Par Leon's confidence that I would quickly pick up the knowledge that I would need to work with him.

Facts, vocabulary and rules could be taught almost instantaneously. Use of language came more slowly. After a couple of weeks I decided that two aspects of the times would be forever beyond me: modern science, and the morality that governed the age. It was no surprise that I would find science difficult. In my own time teachers had regarded me as hopeless as I struggled with Feynman diagrams and was baffled completely by axiomatic field theory. But morals? Surely they should be comprehensible? I comforted myself with the thought that Henry the Eighth would have been appalled at the idea of killing civilians in time of war and baffled by my revulsion at the idea of public executions.

After a month of preparation Par Leon and I were able to begin our work. I would keep my part of the bargain and give him six good, long years for his great lifetime project, the analysis of the musical trends of the late twentieth and early twenty-first centuries. More important than any facts were the perspectives I could offer him. He found it hard to believe how much man-woman and man-man relationships had affected everything in my era. With modern methods of mating dictated by selection of desirable gene combinations, he found it almost unthinkable that people should have mated randomly, on impulse. He was fascinated by my comments. It was a little irritating to him that I had become a Cryo-corpse just before a couple of events that he was especially interested in had happened,

but he accepted that philosophically and with good humor.

While we worked, I learned more about the times. The Solar System was explored, known like the back of a man's hand. Venus had been terraformed, Mars colonized, and there were permanent manned stations—some 'manned' by organic computers—on all the major satellites of the outer planets and on Pluto. Space drives were available that would get as close to the speed of light as you wanted—but few people were interested. The stars were within easy reach, but no one seemed to be stretching out his hands. Civilization seemed changed, content with the limits of the Solar System. I took hypno-courses in astronautics and space systems and became expert in the practice of drive mechanisms. The theory, I suspected, was forever beyond me.

Work went on. I shouldn't give the impression that with Par Leon it was a one-way transfer of information. From his vantage point three hundred and sixty years away, he had developed insights into what was really happening in the musical world of my earlier life that left me gasping. So that was where those musical forms were leading, and that's where Krubak had been aiming in his muchridiculed late works! Something—perhaps the glandular adjustments that the doctors had performed on me—made working with Par Leon a pleasant experience. Previously I had always been something of a loner. To say that I was perfectly content would of course be wrong, but given my preoccupations I was more content than I would have imagined.

The text we were producing steadily grew. By the beginning of the fourth year I knew we were writing

a classic together. During the sixth year we were nearing completion and Par Leon was suggesting the possibility of other collaborations.

After the work was finally complete, Par Leon—a good man by any moral standards I would ever be able to comprehend—helped me to be become established as a composer. It was easier than I expected. Knowledge of the centuries before Cryocorpses was quite spotty, with some big gaps. I could steal tricks from the musical titans of my own past, use them in the modern style, and get away with it. After three years I had a growing reputation (which I secretly knew was undeserved), a group of imitators, and—most important—a substantial financial credit at my disposal.

At last I could wait no longer. I announced that it was time for me to take a long-overdue vacation and see a little more of the Solar System. The night before I left I took Par Leon out for dinner. We went to his favorite place, ate his favorite foods, and drank his favorite wines. Even though I suspected that if I told him the truth he would be my willing accomplice, I did not tell him what we were celebrating or why the occasion was so very special. My plans might involve danger and destruction and I did not want Par Leon to bear any blame when I was gone.

So there we were. Ana and I, together again. We were heading for Canopus in the space yacht that I had rented for a two-month tour of the inner Solar System. Murderer in one era, I was now thief and worse in another. Even with forged papers to help me, it had been a desperate and violent run through the Pluto wombs and the Solar security perimeter

with Ana's Cryo-corpse. Twice I had been within seconds of collision and destruction, but my pursuers' fear of death had exceeded mine. They had changed course to avoid impact and I had fled through their net.

We were traveling at just one hundred and twenty-five meters a second below the speed of light and could get within a meter a second if I chose to. We were moving fast enough. Time dilatation made three years pass on Earth for every day of shipboard time. The trip to Canopus and back would be a little more than two months for us, and two hundred years back on Earth. I felt I could use the time to relax a little. The days before I collected Ana from the Pluto wombs, followed by our escape, had been more than hectic.

I never ceased to be amazed at the capacities of the ship—which, because of time dilatation, mankind seemed to have found no real use for. The mass indicator showed more than one hundred and forty thousand tons, up from a rest mass of a hundred and thirty tons.

To an outside observer I would appear to mass about eighty-eight tons and be foreshortened to a length of less than two millimeters. Although it was hidden from me by the shields, I knew that ahead of us in the forward direction the three-degree background radiation left over from the Big Bang had been Dopplershifted up to visible wavelengths. Behind us, hard X-ray sources looked like pale red stars. And we were nowhere near the ship's limits.

I had started composing again—real music, not pot-boilers or derivative works. In the room aft, Ana lay peacefully in her Cryo-tank. I felt optimistic that two hundred years would be long enough for Earth

to have developed a complete and certain cure. If not, we would head out again and repeat the cycle. There was plenty of time. If Earth could not at last provide our answer, we could go elsewhere, on to the stars to search for other solutions. The ship was completely self-sustaining and had ample power for many lifetimes. I hoped that the single trip would be enough, though; one of my ambitions on our return was to find the Cryo-corpse of my friend Par Leon, and return his favor to me.

As we swept up to the great flaring beacon of Canopus, I decelerated to gravitational swing-by speeds and let the ship fall through a tight hyperbolic orbit around the star. Canopus was a fearsome sight. More than a thousand times as luminous as the Sun, it was sprouting green flares of gas hundreds of millions of kilometers long. I searched for planets and found only four gas-giants, each the size of Jupiter. There were no signs of an inner-planet system.

After two days of fascinated observation I turned the ship and headed back to Earth. Were mine the first human eyes to see the twisting striations—sunscars, not sun-spots—that gouged the boiling surface of Canopus? Like a lost soul flying from Hellgate, I ran for the shelter of our own Solar System. If another trip out were necessary, it would be to a smaller and less turbulent star.

That sight of Hell had affected me more than anything I could remember. It burned in my mind and I could not eat, drink or sleep. The urge to see Ana again, to seek peace in her face, grew on me and at last I went aft. She lay in her tank like a Snowgoddess, with pearly eyelids and skin of milky crystal. I took only one quick look, afraid to open the tank more in case it interfered with the cooling

system. It was enough. I could control myself again and think of other things.

On the tranquil return trip, I wondered again at how easy everything had seemed. I had never thought of light-speed ships and time dilatation when I was making my plans so long ago. At best, I had prepared for a chancy succession of freezings and thawings for me, further and further in time until at last there was a cure and Ana could safely be revived. As it was, Ana was with me; I could safeguard her myself and there was no risk at all.

In we came, past the barren outcroppings of Pluto and on to the inner planets. With no idea how Earth would have changed in two hundred years, I had no way to decide whether I should approach slowly and cautiously or rapidly and confidently. My decision was made for me. As we rode in above the ecliptic, avoiding the asteroid belt, we were locked by a navigation and guidance beam and steered to a landing on the Moon.

The spaceport was new, massive columns set in a regular triangular array. Spaceflight at least had changed since we left. The guidance system set us down gently. Prepared for anything—or so I thought—I stepped through the lock to meet a new generation.

One man greeted me in the lock corridor, a tall dignified figure with the distant eyes of a prophet. Somehow I had expected more, perhaps a show of weapons until my identity was known.

"Welcome again to Earth-space, Drake Merlin."

The language was still Universal. I said I was prepared for anything—but I was not prepared to be recognized and named. I was taken aback, then I realized that the ship's identification was given in

the communication codes, and I would be shown as the last pilot. The data retrieval presumably still held those records. I wondered what else the system showed about my wild flight from Pluto.

"Since you know my identity, then perhaps you also know my history. I am seeking assistance."

The man nodded. "We know your history, and your quest. It has come down to us from ancient times. One version holds that you lost control of your ship and were carried off to the far depths of space. Another tells that your disappearance at light-speed was intentional. Come with me, we will find conversation easier inside the city."

There were small pauses in his words, almost as though he had need to stop and think about many phrases. I wondered if Universal was a learned language to him, as Old Anglic had been to Par Leon. We settled into a reception room, close by the inner lock, and I felt a rising tension. In a few moments I would know if my search was over.

"The Cryo-corpse that you have with you in the

ship. What was the disease?"

"I think there is no word for it in Universal. It disappeared from the race and from the language. The full medical description was given with the womb records."

He nodded. "Do you have the womb catalog

I gave it to him. He stood motionless, eyes distant, for almost five seconds. Then he nodded again. "It can be cured. I have summoned the necessary medical resources."

Two waves of emotion swept over me. Wild joy, and an almost superstitous fear. Telepathy seemed to have been added to the human senses.

"You can transmit your thoughts?" I asked.

He looked puzzled, and again there was a brief silence. Then he smiled.

"Not in the way that you are thinking. I can exchange thoughts with others, and with the data banks, but you will be able to do the same in a few days' time. You will also be able to compute faster and better than the computer of the ship that brought you here. Look."

He turned his head to me and raised the gray hair above his left temple. There was a faint, straight scar there.

"That is the place where the implant is made. There is no reason this could not have been done in the time in which you first lived. A small set of integrated circuits handles calculations—we think in the numbers, just as in your day you did it through finger-pressure on keys.

"The implant is fully programmable. It also contains a signal transmitter and receiver, so that we can enter data and programs directly from the central computers, or from another person. I am speaking to you now in Universal by using the translation pro-

grams on the Tycho computer system."

He caught my look of misgiving. "Do not worry about this. I assure you that in a few months you will find it hard to believe that you functioned without such a service. You will have total recall, be a calculator beyond the most skillful of your time, and you will have immediate access to all the data of the Solar System—though the transmission time is considerable for the data banks of other planets.

"Now, let me query the medical team. They should have made their first examination of the Cryo-corpse in your ship."

He was again silent for a few seconds. Then his eyes widened and he looked at me with a different expression. The silence continued. I felt again a knife of tension twisting inside me, a feeling that something was going wrong.

"What is it?" I said at last. "Have you been in communication with your medical team? What do

they say?"

He nodded. His eyes now seemed different, gentler and closer. He appeared to be choosing his words with great care.

"The woman in the Cryo-tank. Anastasia. When you took her from the wombs of Pluto, was the Cryo-tank fully sealed?"

I could not speak and my mind was filled with foreboding. I inclined my head a fraction of an inch.

"But you opened the tank? After you had left

Pluto?" he asked gently.

"Once. To see her, after we left Canopus. I looked for only a moment, and I sealed the tank again afterward."

I could not tell him that I had been unable to stop myself, I had been driven. Suddenly I was looking at him across a gulf of five hundred and seventy years. His sad face was Tom Lambert's, and Par Leon's also. His eyes were speaking the same message.

"Drake Merlin, the Cryo-tank was intended only for storage in the wombs. After it was opened, the seal was imperfect. You understand what I am saying? Without the correct seal, the temperature in the tank was too high."

He seemed unable to speak for a few moments, and I assume that he was calling for more data from his computer banks. Then he continued. "I have checked with the medical team and with the best data sources. The damage caused to the body when the tank was opened and the seal broken cannot be repaired. There can be no revival; now or ever.

"I am sorry, Drake Merlin. Anastasia is dead.

Forever dead."

Forever dead. Forever dead. The words seemed to echo Tom Lambert, from long ago. This time there was the ring of complete certainty. For each man kills the thing he loves. I had taken the long chance, and now it was over.

There was a long period of introspection, twenty billion nano-seconds of communion with the data banks and the medical teams. As my world collapsed, the barriers came down inside my mind. I noticed for the first time the faint spicy sweetness of the air fresheners, the steady dry breeze blowing past us, and the faint concert pitch A-natural of vibrating metal far along the corridor. My senses were opening again, after long centuries of hibernation.

At last he spoke again. "One possibility remains. Anastasia, the woman you knew, cannot be reanimated. Whole cells remain and she can be cloned without difficulty, but growth and education would begin anew. There is no hope of sufficient memory transfer from undamaged cells for more than a faint inkling of her former self to pass to her new body. Your former close relationship would be irrelevant to her. Should we proceed?"

I wanted to say yes, but caution held me. "Why would you do this for us? What will the price be, to me or to her?"

Shrugged shoulders had retained a meaning, although I could not see how such information would be transferred through a communication implant.

"You would be deprived of an implant and you would not share our group-consciousness. Call it an experiment. The group-mind has become curious about the behavior of single units such as you, not connected through the implants. Also, we have a feeling that in the old emotional patterns can only be called sympathy. Your suffering is unique. No quest comparable with yours is recorded in the data banks, unless it is the fragmented and confusing description of Orpheus and Eurydice.

"Shall we proceed?"

Only one answer was possible. "Proceed."

Coda and Overture.

So it begins. Anastasia lies in my arms again, for the first time in more than five hundred and seventy years. She weighs a little more than five kilos and is just three weeks out of the clone-womb. It took me an eternity to learn it, but by now I know better than to cast dice against the future. In twenty years' time, I may be no more than father and mentor to her. It will suffice.

Introduction:

Larry claims it was his great good fortune to come upon the sf scene at the height of the "New Wave." As he tells it, all the other new writers (and many of the older ones as well) were so busy composing Serious Literature that the field was wide open for someone with a story to tell—and a science fiction story at that. For me, though, the thing about Niven's work that is most appealing is not his way with a plot or even his marvelously inventive extrapolations. It is his poetic vision. He, more than any other writer, evokes a sense of the magic that inheres to this universe.

Sometimes that vision is expressed in pure yet outrageously plausible whimsy: the cowardly puppeteers, with their heads in their hands. Sometimes it is in a darker vein, as with "Down and Out."

DOWN AND OUT

by Larry Niven

T

THE NAMING OF NAMES was important to Corbell. Alone in his little universe, dissociated from all mankind, with only himself and his bland-voiced computer to talk to, Corbell hung tags on everything.

He called himself Jaybee Corbell.

Yes, it was a major decision. For awhile he was calling himself CORBELL Mark II (Corpsicle Or Rebellious Brain-Erasure: Lousy Loser). He gave that up after the shape of his new nose stopped bothering him, after he got used to the look and feel of his shorter arms and slender hands, his alien body. There were no mirrors on the ship.

What he called the Kitchen was a wall with slots and a menu display screen. The opposite wall was the Health Club: the exercise paraphernalia and the outlets that would turn this chamber into sauna or shower or steam bath. The medical dispensary and diagnostic tools were Forest Lawn: the cold sleep tank was also in that room.

The control room was a hollow sphere with a remarkable chair in the exact center, surrounded by a horseshoe bank of controls, and approached via a catwalk of metal lace. That chair would assume a fantastic variety of positions, and it gave indecently good massages. The spherical wall could disappear to display the black sky as if Corbell and the control bank floated alone in space. It would display textbooks on astronomy or astrophysics or State history, or updated diagrams of the ship. Corbell called it the Womb Room.

The autopilot-computer could be voice operated from anywhere aboard. Or there was the computer link; a helmet like a hair dryer with a thick cord attached, that would plug Corbell directly into the computer's senses. Corbell was afraid to use it. He was afraid to personalize the computer. He spoke to it only to give orders and request information, and he named it, "Computer".

But he dithered for months before naming the great seeder ramship he had stolen from Pierce and the State. *Don Juan*, he called it, for its phallic

overtones.

Trivial decisions . . . but that was Corbell's problem. He had already made his major decisions. That was his finest hour, when he broke free of Pierce the checker and drove for the galactic core. *Don Juan* should have capped his career then, by blowing up.

Pierce the checker had explained it all.

He had been—someone had been—Jerome Branch Corbell the architect. Someone named Corbell, dying of cancer, had declined to die as anyone else died. This Corbell had had himself entombed in a double-walled coffin, the outer filled with liquid nitrogen. He had hoped to be reawakened after medical science solved twin problems: a cancer cure, and a cure for the damage done by ice crystals rupturing cell walls.

It hadn't worked out that way.

Later there had been a criminal. CORBELL Mark II never knew his name or his crime. The State had wiped a criminal's personality, memories, self. Into the empty brain the State had played electrical currents trapped in the frozen brain of Jerome Corbell. The State had ground this Corbell into hamburger and leeched the hamburger for memory RNA; this they had injected into a criminal's veins.

"Jerome Corbell is dead," Pierce the checker had explained. "I could have given you his intact skeleton for a souvenir." The new Corbell had no more

civil rights than a dead man.

In practical terms, the State had created a man with a lust for privacy and an internal self-sufficiency very rare among State citizens. Such a man would have had to adapt to an unfamiliar culture anyway; had in fact volunteered for that task. Why should he not postpone that adaptation for two hundred years, while he guided a seeder ramship around a bent ring of stars? He would return a hero of sorts. He would have started a dozen uninhabitable worlds on the road to becoming colonies, new territory for the State.

The new Corbell was to be a rammer. His alternative—

"You're wrong to call it slave labor," Pierce had told him. "A slave can't quit. Your crime has cost you your citizenship, but you still have the right to change professions. You need only ask for another, um, course of rehabilitation." But he meant death. Corbell's was the fourth personality to be tested in that empty body.

What Pierce expected of Corbell was complete, enthusiastic obedience. Otherwise there would be a

fifth personality living in the criminal's body.

Pierce had had his obedience during Corbell's entire period of training . . . training that went rapidly, because it was augmented by injections of memory RNA. Corbell suspected where the injections had come from. He had obeyed orders until he was actually in command of the huge spacecraft. Then, around the orbit of Jupiter, he had started his turn.

Don Juan was a Bussard ramjet. Its fuel was interstellar hydrogen, gathered in by magnetic fields and burned in fusion fire. Unlimited fuel. According to the autopilot-computer, Don Juan could accelerate at one gravity forever. With relativistic time compression to help him, Corbell could reach the galactic core in twenty-one years of ship's time... and return to a world seventy thousand years older, his crime seventy thousand years forgotten.

Or perhaps he would not return at all. Even the State did not know what Corbell would find at the galactic core.

Twenty-one years from now he could make his next major decision.

A year on his way, and Corbell was starving for the sound of another voice.

He dithered. What could Pierce say that would be worth the hearing? He had hung up on Pierce, he had had the computer disconnect the message laser receiver, as a gesture of contempt. That gesture was important. Could Pierce *know*, never mind how, that he was no longer talking to a void?

Corbell held lengthy conversations about it. "Can I possibly be that lonely?" he demanded of himself. "Or that bored? Or that desperate to hear another human voice again? Other than my own—" His own voice echoed back from the Womb Room walls.

"Computer," he said at last, "reconnect the message laser receiver." And he waited.

Nothing. Hours passed, and nothing.

He was savage. Pierce must have given up. Somewhere in the city Pierce would never show Corbell, Pierce the checker would be training another revived corpsicle.

The voice caught him at breakfast three days later.

"Corbell!"

"Hah?" That was strange. Computer had never addressed him before. Was it an emergency?

"This is Peerssa, you traitorous son of a bitch! Turn this ship around and carry out your mission!"

"Get stuffed," Corbell said, feeling good.
"Get stuffed yourself," said the voice of Peerssa, turned suddenly silky-smooth.

Something was wrong here. Don Juan was almost half a light year from Sol. How could Peerssa... "Computer, switch off the message laser receiver.

"That won't work, Corbell! I've beamed my personality into your computer, over and over again for these past seven months! Turn us around or I'll cut off your air!"

Corbell yelled something obscene. The silence that followed commanded attention. The purr of air moving through the life support system was a sound he never heard anymore; but he heard its absence.

"Turn that back on!" he cried in panic.

"Will you bargain, Corbell?"

"Never! I'll throw-" What was heavy and movable? Nothing? "I'll pry the microwave oven loose and throw it into the computer! I'll give you nothing but a wrecked ship!"

"Your mission—'

"Shut up!"

The voice of Pierce the checker was silent. Cor-

bell heard the purr of moving air.

What next? If Pierce controlled the computer he controlled everything. Why didn't he turn the ship himself?

Had he? Corbell climbed up into the Womb Room and settled in the control chair. "Full view," he commanded.

He floated alone in space.

Half a light year of distance had not changed the pattern of the stars. A year of acceleration had. *Don Juan* was now meeting all light rays at an angle, so that the entire sky was puckered forward.

In his first life, during nights spent aboard a small boat, Corbell had learned a nodding acquaintance with the constellations. Sagittarius was just where he had left it, directly overhead. A ring of white flame around and below him was hydrogen guided and constricted to fuse in stellar fire: the exhaust of his drive. Sol was a hot pink point beneath his feet . . . and something flickered across it.

Corbell, staring, made out a humanoid form barely blacker than space, walking toward him across the stars. Coming close.

Narrow features, light hair . . . it was Pierce. Corbell watched, barely breathing. Pierce was as big as *Don Juan*. Pierce was angry . . .

Corbell said, "Computer, get that mannequin off my screen.".

The figure vanished.

Corbell resumed breathing. "Pierce, or Peerssa, or Computer, or whatever name you will answer to, I give you your orders. You will proceed to the galactic axis under one gravity of acceleration, making turnover at midpoint. You will take all necessary steps to guard my life and the integrity of the ship, subject to this mission. Now speak if you like."

The voice of Pierce the checker said, "I prefer Peerssa."

Corbell sighed his relief. "So do I. Are you in fact under my orders?"

"Yes. Corbell, there are things we must discuss. You owe your very existence to the State. You've stolen a key to the survival of mankind itself! How many seeder ramships do you think will succeed in converting alien atmospheres to something men can breathe? Or do you think that men will never need to leave the Earth?"

"Computer, you will henceforth answer to the name Peerssa. Peerssa, shut the fuck up."

Silence.

Now Corbell caught himself giggling occasionally. It could happen any time. At meals, or sitting in the Womb Room watching the sky, or using the Health Club, he would suddenly start giggling. And then he couldn't stop, because Peerssa could hear, and Peerssa couldn't answer—

Peerssa. The naming of names: Pierce the checker was far in Corbell's past, while Peerssa was a personality imposed on a computer's memory bank. The distinction was worth remembering. There would be major differences between the man and the computer. Peerssa had different senses. Peerssa would never suffer hunger pangs or a frustrated sex urge. Peerssa would never exercise or use the rest room. Peerssa might well have no sense of self preservation. That was worth finding out.

And Peerssa was compelled to follow orders. Peerssa was Corbell's slave.

Two weeks passed before Corbell gave in to the urge for conversation. Seated in the control chair, floating among stars that were already brighter and

bluer above than below, Corbell said, "Peerssa, you may speak."

"Good. You've instructed me to guard your life and the ship. I can't maintain one gravity all the way

without killing you and wrecking the ship."
"Don't lie to me," Corbell snapped. "I checked it out on the computer before I ever passed Saturn. The ram effect works better at high velocities, because I can narrow the width of the ram fields. Greater hydrogen flux."

"You used data already in the computer."

"Yes, of course."

"Corbell, that data was meant for jumps of up to fifty-two light years. Not thirty-three thousand. We built the field generator as strong as possible, but it will not stand one gravity at your peak velocity. The strains will tear it apart. We'll have to decrease thrust starting three years from now, if you want to live."

Pierce the checker had never lied, had he? Pierce had never bothered. Why lie to a corpsicle? Peerssa was something else again. Corbell said, "You're ly-

"I deny it. Make up your mind, You've ordered me not to lie. Am I under your orders? If not, why don't I just turn and head for Van Manaan's Star?"

Corbell gave up. "This ruins my itinerary, doesn't it? How long will it take us to reach the Core?"

"In near-perfect safety, about five hundred years."

"Give me . . . oh, a ninety percent chance of getting there alive. How long?"

"Computing. Insufficient data on interstellar mass density. We'll correct that on the way. One hundred and sixty years four months, confidence of ten months, all figures in ship's time."

Corbell felt cold. That long? "Suppose we don't go direct? We could skim above the plane of the galaxy—

and thin out the interstellar matter. Computing. Good, Corbell. We lose some time thrusting laterally at turnover, but we still shave some time. One hundred and thirty-six years, eleven months, confidence of a year and a month.

"That still isn't good."

"And you'd spend the same time coming home. You'd get home dead, Corbell. We could finish your

original mission faster than that. Well?"

"For—" Never say Forget it to a computer. "You have your orders. I now amend them. Your mission is to get us to the galactic axis in minimum ship's time relative, ninety percent confidence of getting me there alive "

"You'll never see Earth again."

"Shut up."

"You may speak."

Silence.

"Does it bother you, being cut off like that?"

"Yes, of course it bothers me. I've been silent for a week. That's four weeks added to our trip time. The longer it takes me to persuade you, the longer it will take us to complete our mission!"

"I could order you to give up that idea."

"I would do it. Snarling of my circuits might result. Corbell, I appeal to your sense of gratitude. The State created you, you owe your very existence-

"Bullshit."

"Is it that easy for you to ignore your duty?"

Corbell swallowed an urge to drive his fist through a bank of dials. "No, it's not easy. Every

time you raise the holy name of the State, something in me snaps to attention."

"Then why not listen to the voice of your social

conscience?"

"Because it's not my conscience! It's those damn shots! You filled me full of memory RNA, and that's where my sense of duty to the State is coming from!"

Peerssa gave it a good dramatic pause before he said, insinuatingly, "Suppose it's your conscience

after all?"

"I'll never know, will I? And that's your doing, isn't it? So live with it."

"You will never see Earth again. Your medical

facilities will not keep you alive that long."

Corbell snorted. "Don't be silly. The medicines and the cold sleep tank are supposed to keep me young and healthy for the first two hundred years. The cold sleep tank has a rejuvenating effect, remember?"

"It doesn't. I lied. You were to remain alive for the duration of your mission. If the medicines had been better, we would have extended the mission."

"You sons of bitches." It rang true; it fitted well

with what Corbell knew of the State.

"Corbell, listen to me. In three hundred years the State may discover complete rejuvenation. We could arrive home in time—"

"For non-citizens?"

No answer.

"We're going to the galactic axis. You have your orders."

"You must enter cold sleep immediately," Peerssa said in a dead voice.

"Oh?"

"Your optimum program is ten years in cold sleep,

six months to recover, then cold sleep again. You will survive to see the galactic axis, barely."

"Uh huh. And if you happened to forget to wake

me up?"

"That's your problem. Traitor."

II

RAW THROAT. Cramped muscles. Eyes that wouldn't focus. Questing hands that found him in a coffin with the lid still on.

Waking from cold sleep was like waking from death. This was what he had half-expected in 1970, when they froze Jerome Corbell to stop the cancer that was eating him from the inside. And he had half-expected never to wake. He whispered, "Peerssa."

"Here. Where would I go?"

"Yeah. Where are we?"

"One hundred and six light years from Sol. You must eat."

Suddenly Corbell was ravenous. He sat up, rested, then climbed down from the tank, treating himself like fragile crystal. He was lean as death, and weak. "Fix me a snack I can take to the Womb Room," he said.

"It will be waiting."

He felt light-headed. No, he felt *light*. He picked up a large bulb of hot soup in the kitchen, and sucked at it as he continued to the Womb Room. "Give me a view," he said.

The walls disappeared.

The stars blazed violet-white over his head. The stellar rainbow spread out from there; violet stars in

the center, the rings of blue, green, yellow, orange, dim red. To the sides and below there was almost nothing: a dozen dim red points, and the feathery ring of flame that marked his drive. That had dimmed too, for Peerssa had pulled the ram fields close, and had reddened, because the fuel guided into that ring was moving at near lightspeed relative to the ship.

Peerssa was bitter. "Are you satisfied? Even if we turned back now, we have lost over four hundred vears of Earth time—"

"You bore me," said Corbell, though he felt stabbing pain from what he would once have called his conscience. "What happens next?"

"Next? You eat and exercise. In six months you

must be strong and fat—"

"Fat?"

"Fat. Otherwise you could not survive ten years in cold sleep. Finish your soup, then exercise."

"What do I do for entertainment?"

"Whatever you like." Naturally Peerssa was puzzled. The State had provided nothing for Corbell's entertainment.

"Yeah, I thought so. Tell me about yourself, Peerssa. We're going to be together a long time."

"What do you want to know?"

"I want to know how you got to be this way. What was it like to be Peerssa the checker, citizen of the State? Start with your childhood."

Peerssa was a poor storyteller. He rambled. He had to be led by appropriate questions. But he had more than his voice to tell tales with.

He was an inept motion picture director with an unlimited budget. On the wall of the Womb Room he showed Corbell the farming community where he had grown up, and the schools of his childhood (skyscrapers with playgrounds on the roof), and the animated history texts he had studied during his final training. The memories were usually hazy. Some were shockingly sharp and brightly colored: the enormous ten-year-old who bullied Peerssa on the exercise roof; the older girl who showed him sex and thus frightened him badly; his Civics teacher.

Corbell ate and slept and exercised. He tended Don Juan with the half-instinctive love and understanding absorbed with his rammer training. In between, he had from Peerssa all the knowledge he had not dared demand of Pierce the checker.

He saw views of Selerdor, the city he had only glimpsed from a rooftop. The buildings were as blocky and unimaginative inside as out. The carvings at street level were in Shtoring, the State language. They were edifying principles, rules of conduct, or the life stories of State heroes.

He grew to know Peerssa as well as he had known Mirabelle, his wife for twenty-two years. In knowing Peerssa he grew to know the State. The computer memory held what Corbell would have called Civics texts. He read those, with helpful comments from Peerssa.

He learned of the two brushfire wars that had half destroyed the Earth and eventually established the State. The State was all-powerful, as he had guessed. It was a fascism, with distinct overtones of Chinese or Japanese Empire. Society was drastically stratified. The government controlled every form of industrial power generator. Once these had been very diverse: dams, geothermal plants, temperature differential plants in the ocean depths; now they were big fusion generators supplemented by rooftop

and desert solar collectors. But the State owned them all.

Once he asked, "Peerssa, do you know what a water empire is?"

"No."

"Pity. A lot of civilizations were water empires. Ancient Egypt, ancient China, the Aztecs. Any government that controls irrigation completely is a water empire. If the State controls electricity, they also control the fresh water supply, don't they? I mean, with a population in the billions—"

"Yes, of course."

Musing, he said, "I once asked you if you thought the State would last fifty thousand years."

"I don't."

"I think the State could last seventy thousand. See, these water empires, they don't collapse. They can rot from within, to the point where a single push from the barbarians outside can topple them. But it takes that push. There's no revolution in a water empire."

"That's a very strong statement."

"Yeah. Do you know how the two-province system works? They used to use it in China. Say there are two provinces, A and B, and they're both having a famine. What you do is, you look at their records. If Province A has a record of cheating on their taxes or rioting, then you confiscate all the grain in Province A and ship it to B. If the records are about equal you pick at random. The result is that Province B is loyal forever, and Province A is wiped out so you don't worry about it."

"We rarely have famines. When we do—" It was rare for Peerssa not to finish a sentence.

"There's nothing more powerful than controlling everybody's water. A water empire can grow so feeble that a single barbarian horde can topple it. But, Peerssa, the State doesn't have any outside."

Much later, Corbell learned that he had changed his life again. At the time he only suspected, from Peerssa's silence, that he had offended Peerssa.

And Peerssa was not Pierce. The checker was long dead; the computer personality had never harmed Corbell. It was worth remembering. Corbell gave up talking about the State. Peerssa was loyal to the State; Corbell most emphatically was not.

Six months passed. Stars passed too. A few passed close enough to show like violet windows into Hell, and receded like dim red fireballs. Corbell was fat, too fat for his own tastes, fat enough for Peerssa's, when at last he climbed into the great coffin.

It happened seven times.

Ш

"CORBELL? Is something wrong? Speak, please."

Corbell sighed in the cold sleep tank. He did not move: He had become very used to this routine: the terrible weakness, the hunger, the six months of exercises and of forcing insipid food down his throat, the climbing into the tank to start the cycle over. At this, his seventh awakening, he felt a deadly reluctance to wake up.

"Corbell, please say something. I can sense your heartbeat and respiration, but I can't see you. Have you turned catatonic? Shall I administer shock?"

"Don't administer shock."

"Can you move, or are you too weak?"

He sat up. It made him dizzy. Ship's thrust was very low. "Where are we?"

"Beyond midpoint of our course, thrusting later-

ally to force us back into the plane of the galaxy. Proceeding according to plan. Your plan, not mine. Now I want to monitor your health."

"Later. Make me soup. I'll take it to the Womb Room." He moved toward the kitchen, bouncing oddly in the low gravity. He had aged more than the four years he had been awake. After each awakening the exercises had taken longer to build him up again. He felt brittle, and ravenous.

The soup was good. The soup was always good. He settled himself in the Womb Room and let his eyes roam the dials. Some of the readings were frightening. The gamma ray flux would have charred him in minutes, if the power of the ram fields were not guiding the particles aside. Other readings made no sense. Peerssa had told the truth: the seeder ramship was not designed for velocities this close to the speed of light. Neither were the instruments and dials.

And what about Peerssa's senses? Was he flying half blind?

"Give me a full view," he said.

The stellar rainbow had hardened and sharpened over seven decades. It had lost symmetry too. To one side the stars were thickly clustered; the arc of blue-whites blazed like diamonds in an empress' necklace. To the other, the side that faced intergalactic space, the rainbow was almost dark. Each star was sharply defined within its band of color. But within the central disc of violet stars (dimmer than the blue, but of a color that made one squint) was a soft white glow: the microwave background of the universe, at 3° Absolute, boosted to visible light by Don Juan's terrible speed.

His ship's drive-flame had become a blood red fan

of light facing intergalactic space. Peerssa was thrusting laterally to bend their course back into the plane of the galaxy.

"Give me a corrected view," Corbell instructed.

Now Peerssa worked a kind of fiction. From the universe he perceived through the senses of *Don Juan's* hull, he extrapolated a picture of the universe seen at rest, and he painted that picture around the wall of the Womb Room.

The galaxy was incomparably beautiful, a whirlpool of light spread out across half the universe. Corbell looked ahead of him for his first view of the galactic core. It was there, just brighter than the rest, and hazy, without definition. He was disappointed. He had thought the close-packed ball of stars would flame with colors. He could pick out no individual stars; only a vague glow around a central bright point. Behind him the stars were similarly blurred.

"I'm getting poor definition in the view aft," Peerssa volunteered. "The light is drastically redshifted."

"And forward?"

"This is not according to theory. I would have expected more definition within the core. There must be a great deal of interstellar matter blocking the light. Even so . . . I need more data."

Corbell didn't answer. A multiple star cluster had caught his eye, half a dozen brilliant points whirling frantically as they came toward him. They passed on the right, still jiggling madly, and froze in place as they came even.

"The next time that happens, I'd like to see an uncorrected view."

"I'll call you, but you won't see much."

So here he was at the halfway point, with his destination in sight. No man before him could have seen the glow of the galactic core, or the frantically spinning star cluster flashing past at this close to light-speed. His enemy's soul had become Corbell's slave.

Corbell flies toward the core suns like a moth toward a flame, expecting death. But he has his victories.

He finished his anonymous soup. Don Juan's kitchen and/or chemistry lab supplied just enough taste, just enough variety, to keep a State noncitizen from cutting his throat. On such fare he must grow fat . . . and exercise to distribute the fat. Lately it tended to settle in a pot belly, which was no help at all.

He was getting old. Despite the cold sleep tank and all the medicines available, he would be decrepit before they reached the core suns.

His second life should have been more like his first. He had hoped to make friends, to carve out some kind of career . . . he had been frozen at age forty-four, there would have been time . . . time even for a marriage, children . . .

Things would look better when he had built up some strength. He could go on an oxygen drunk. On request Peerssa would fill the cabin with pure oxygen, while lecturing Corbell on the adverse medical effects for as long as Corbell would let him.

"About now you usually start telling me my duty," he said.

"There's no point," said Peerssa. "We're decelerating now. We'll be among the core suns before we can brake to a stop."

Corbell smiled. "Anyone but you would have

given up sooner. Expand my view of the core suns,

please."

The hub of the galaxy rushed toward him. Dark clouds with stars embedded in them surrounded a bright core. They looked like churning storm clouds. They had changed position since his last waking period.

But the core itself was a flat featureless glow, except for a single bright point at the center. "The interstellar matter must be almighty thick in there.

Can our ram fields handle it?"

"If we give up thrust and settle for shielding the life support system and nothing else, you'll be amazed at what we can handle."

"I'll be dying anyway, of old age."

"Corbell, there is a way you can go home again."

"Dammit, Peerssa, have you been lying to me?"

"Calm down, Corbell. There is a way to make you young, if you're willing. You can understand why I didn't raise the subject before."

"I sure can. Why now? Why would you do this for

someone who betrayed your precious State?"

"Things have changed, Corbell. By now we may be the last remnants of the State. And you weren't even a citizen."

"And you are?"

"I am a human personality imposed on a computer's memory banks. I could never be a citizen. You could have been. Such as you are, you may well represent the State. The State may not survive the seventy thousand years we will be gone. You are worth preserving."

"Thank you." Unreasonably, Corbell was

touched.

"The State may exist only in your memory. I'm

glad you forced me to teach you Speech. I'm glad I told you so much about myself. You must live."

"Make me young," Corbell said with the fervor of a man growing old much too fast. "What does it take?"

"We have the equipment to take a clone from you. You surely find nothing strange about the concept of cloning?"

"We knew about it. Cloning of carrots, anyway.

But—'

"We can clone men. We can clone you. Let the individual grow in sensory deprivation, in your cold sleep tank. We can record your memories and play them into the clone's blank mind."

"How? Oh, of course, the computer link." The link was a direct telepathic control over the computer. Corbell had never dared use it. He had been doubly afraid of it since Peerssa became the computer. Peerssa might use it to take him over.

Peerssa said, "We will also need injections of your

memory RNA."

Corbell yelped. "You're talking about grinding me up into chemically leeched hamburger!"

"I'm talking about making a young man of you."

"It wouldn't be me, you madman!"

"The new individual would be as much Jaybee

Corbell as you are."

"Thanks! Thanks a lot! You told me what happened to the real Jaybee Corbell. A brainwiped criminal! No, thanks. There isn't going to be a CORBELL Mark III."

Six months later he was not ready for the cold sleep tank. "You've been shirking your exercises," Peerssa said.

Corbell had just finished an exercise period. Tendonitis had led him to favor his arms, these past two months, but they hurt anyway, two hot wires in his shoulders. "It's your schedule," he grumbled.

"I would have to thaw you early. Coming out of cold sleep is a trauma. You want to reach the galactic core in optimum condition. Take another two months awake."

"Fine. I hate that damn tank anyway." Corbell slumped in a web chair. In near-free fall he was too prone to lose muscle tone. His pot belly protruded.

He had nobody else to talk to, and Peerssa had endless patience. It should have been good timing when Peerssa said, "Have you given any thought to regaining your youth?"

Corbell shuddered. "Forget it." Hastily, "I don't mean that literally. If you wipe it from your memory

banks, you'll only think of it again later."

"I take it you've cancelled your command. What is your objection?"

"It's ugly."

"As things stand now, you will die of aging on the return voyage. The cold sleep treatment is not enough."

"I will not be ground up for hamburger. Not

again."

"You know the details of Don Juan's excrement recycling system. Do you find that ugly?"

"Since you ask, yes."

"But you eat the food and drink the water."

Corbell didn't answer.

"You would be a young man when it was over."
"No. No, I would not." Corbell was shouting. "I would be hamburger! Contaminated hamburger, garbage to be recycled for the benefit of your damn clone! He wouldn't even be a good copy, because you'd be shoving some of your own thoughts in through the computer link!"

"You have no loyalty to anything but yourself."

Corbell thought: I can shut him up. Any time. He said, "Whatever it is I am, I'll settle for it."

"The only man who ever saw the galactic core. A wonderful thing." Peerssa had had time and practice to develop that sarcastic tone. "What will you do afterward, once your sole ambition in life is satisfied? Will you order me to self-destruct? A grand funeral pyre for your ending, a fusion flame that alien eyes might see?"

Then Corbell did Peerssa an injustice. "Is that what's been bothering you? Tell you what," he said. "After we have our look around the core suns, why don't we drop some package probes on appropriate planets? You can reach Earth alive. By the time the State sends ships, the algae will have turned some reducing atmospheres to oxygen atmospheres. You can take my mummy home, too, in the cold sleep tank. Maybe they'll want it for a museum."

"You will not be young again?"

"We've been through that."

"Very well. Will you go to the Womb Room, please? I have a great deal to show you."

Mystified and suspicious, Corbell went.

Peerssa had set up displays in the Womb Room walls. There was a greatly enlarged, slightly blurred view of the galactic core as Corbell had seen it six months ago: drastically flattened, the glow of the suns blurred by interstellar matter. There was a contrasting enlargement of the center of the spiral galaxy in Andromeda. There was a diagram: an oddly contoured disc cut down the center. Corbell frowned, wondering where he had seen that before.

Peerssa spoke as he settled himself in the control chair. "I have never known why you chose the galactic axis as your destination. I may never understand that."

The core of Andromeda Galaxy glowed with colored lights. Corbell pointed. "For that. For beauty. For the same reason I once went through the Grand Canyon on muleback. Can you imagine a planet on the edge of that sphere? The nights?"

"I can do better. I can put it before you, by extrapolation." And Peerssa did. Corbell's chair floated above a dark landscape. The sky was jammed with stars competing for space, big and little, red and blue and pure white, and a spinning pair that threw out a spiral of red gas. The sky turned. A wall of blackness rose in the east, ten thousand cubic light years of dust cloud . . . and then the Womb Room was as it had been, while Corbell was still gaping.

"I could have done that before your first term in the cold sleep tank. We could have completed your mission, seeded the worlds assigned to you, and I could have displayed that sky for you at any time.

Why didn't you say something?"

"It's not real. Peerssa, didn't any of your aristocrats ever go cruising through, say, Saturn's rings, just for the joy of it?"

"For the mining possibilities—"

"Mining. If they said that, they lied."

"Are you sorry you came?"

Why had he kept on? Knowing that the trip would take more than twenty-one years, that it would take his *life*, had not changed his mind. Corbell the reconstituted corpsicle would never carve out a normal life for himself. Very well, he would do *something* memorable.

"No. Why should I be sorry? I expected strangeness in the galactic core. I was right, wasn't I? It's nothing like other galaxies, and I'm the first to know it.

"You're insane. Imagine my amazement. Never mind. Your choice has had unforeseen consequences. We expected a close-packed sphere of millions of suns averaging a quarter to half a light year apart, with red giant suns predominating. Instead, we find this: the matter in the core forced into a disc that flattens drastically toward the center, with a tremendously powerful source of infrared and radio energy at the axis."

"Like vour diagram?"

"Yes, very like this diagram which I find in my data banks, a representation of the structure of the accretion disc around the black hole in Cygnus X-1."

"Oh!" He had not seen that diagram during his rammer training. His rammer training had not even told him how to avoid stellar-sized black holes, because there were none to be expected on his planned course. He had seen something very like that diagram in an article in Scientific American!

"Yes, Corbell. Your wonderland of lights is being absorbed by a black hole of galactic mass. Its spin must be enormous, from the way it has flattened the mass of stars around it. Eventually the entire galaxy

may disappear into—Corbell? Are you ill?"
"No," Corbell said, his hands covering his face, muffling his voice.

"Don't be depressed. This is your chance for life."

"What?"

"A thin chance to see Earth again before you die. A unique experience, win or lose. Isn't that what you want? Let me explain . . .

IV

AT THE THIRTEENTH awakening he tried to sit up too fast. He woke again, dizzy, flat on his back in the coffin, with Peerssa calling in his ear. "Corbell! Corbell?"

"Here. Where would I go?"

"Be more careful. Lie there for a minute."

Lean as death he was, and old. Arthritis grated in his knobby joints. With the familiar hunger came nausea. He ran a hand over his scalp—he had been half bald when he entered Forest Lawn—and more of his hair came away.

"Where are we?"

"One month from target and closing. The view will please you."

He emerged from the cold sleep tank like a sick Dracula. He made his limping way to the kitchen, then to the Health Club. His muscles were slack and tended to cramp. The exercises were hard on him. But the pain and the nausea and the creeping years meant little. He felt good. At worst he had found a brand new way to die.

He asked of the ubiquitous microphones, "Suppose we go too far in? We won't ever die, will we? We'd be stopped above the Swartzchild radius."

"Only to an outside observer. Not to ourselves. Are you about to change my orders?"

Some minutes later he eased himself into the Womb Room chair. He sipped the last of the broth. "Full view."

Don Juan raced above a sea of churning stars. In a normal galaxy they would have been crowded enough. Here, forced into a plane by the spin of the giant black hole at the center, they were crowded to death. Dying stars burned with a terrible light. They stood like torches in a field of candles. It must be common enough for star to ram star here, or for tides to rip stars apart.

Commoner toward the center, Corbell thought. The center of the sea burned very bright ahead of him. He could see no dark dot at the axis. He hadn't expected to.

"How far away are we in normal space?"

"Real space? Three point six light years."

"No problems?"

"I believe I can hold us above the plane of the disc until we have passed that very active swelling ahead of us, between two and three light years from the singularity."

Corbell looked down at his drive flame, a wisp of white flame between his feet. It was dim. There was very little matter above the disc, he guessed. "Suppose you can't? Suppose we have to go through it?"

"You'll never feel a thing. That region is where the stars lose their identity. They become streamers of dense plasma with nodules of neutronium in them. Most of the light comes from there. Beyond, there is a very great flattening and some radiation due to friction in the matter spiralling inward."

"What about the black hole?"

"I still don't have a view of it. I estimate a circumference of two billion kilometers and a mass of one hundred million solar masses. The ergosphere will be large. We should have no trouble choosing a path through it."

"You said circumference?"

"Should I have given you the radius? The radius of a black hole may be infinite."

There was simply no grasping the size of that disc

of crushed stars. It was like flying above another universe. At two billion kilometers, the black hole would almost have contained the orbit of Jupiter; but if Corbell could have seen past that swelling ahead, that Ring of Fire, he would have found the black hole invisibly small.

Light caught the corner of his eye, and he turned to see a supernova glaring white-on-red. He'd just missed seeing a sun torn apart by tides, its tenmillion-degree heart spilled across the sky.

He asked what he had never asked before.

"Peerssa, what are you thinking?"

"I don't quite know how to answer that."

"Try."

"I'm not thinking anything. My decisions are made. They are mathematically rigorous. I face no choices."

"How are you going to find Earth?"

"I know where Sol will be in three million years."

"Three—Won't it be more like seventy thousand?"

"We're driving deep into a tremendous gravity field. Time will be compressed for us. The black hole is large enough that tides will not tear us apart, but we'll lose almost three million years before I fire the fusion motor. What more can I do? The odds are finite that we will find Sol. Or the State may have spread through a million cubic light years of space before we arrive."

"The odds are finite. Peerssa, you're strange." But Corbell felt no urge to laugh. Seventy thousand years BC, there had been Neanderthal Man and a few Cro-Magnon Humans. Three million years ago, nothing but a club-swinging, meat-eating ape. What would inhabit the Earth three million years from now?

Now Corbell spent most of his time in the Womb Room, watching the accretion disc swirl past. He liked the uncorrected view, the display that showed the universe distorted by Don Juan's velocity.

Since turnover the ship had shed most of its Tau factor. Don Juan had been moving faster after Corbell's first term in the cold sleep tank. But it was still traveling near lightspeed, and accelerating steadily under the pull of a point-source one hundred million times the mass of the Sun. The accretion disc showed rainbow-colored ahead of him, with the Ring of Fire a violet-white hill coming near. The stars were jammed together; you couldn't tell one from the next unless the next had exploded. They graded back through the rainbow until the sea of flame behind Don Juan was deep red and frozen in place, with the occasional supernova showing yellow-white or greenish-white.

The Ring of Fire—the swollen region where the heat trapped within the streaming star-stuff grew even more powerful than the black hole's compression effect—came near. It was blinding-bright before Corbell gave up. "Reduce that light," he said,

half-covering his eyes.

"I've cut it to ten percent. Let me know when I must cut it again."

"Are you all right? Will it burn out your cameras?"

"I think not. Remember, you were to dive almost into Sol to decelerate at the end of your mission. We can handle high intensities of light."

The Ring of Fire was a flattened doughnut twenty light years in circumference, a quarter of a light year thick: four or five cubic light years of green-toblue-white star, with every possible grade of fusion and fission going on in it. As if Hell were a tremendous mountain...coming near...and Don Juan crossed it on a fan of fusion flame, thrusting hard. Corbell felt the thrust drop away. He sat forward as the ship dropped along the inner gradient and left the Ring of Fire behind, a dull red wall. The inner accretion disc was drastically thinner, savagely compressed. Corbell peered toward where the black hole ought to be. All he saw was more starmatter, hurtingly violet-white at the center.

It was all happening terribly fast now. Minutes left, or seconds. Peerssa was firing the attitude jets at strange angles. There were no stars to see in this inner disc; no detail at all. It was as uniform as peanut butter.

"It's all neutronium," said Peerssa. "It even has some of neutronium's crystalline structure, but that structure is constantly breaking up. I can see the

X-ray flashes, like ripples."

"I wish I had some of your senses."

"The computer link—"

"No."

Behind them the Ring of Fire reddened further and was gone. The inner disc grew brighter and bluer and was suddenly past. In the last instant Corbell saw the black hole.

The onboard fusion drive roared beneath him, slammed him down into his chair. Light exploded in his face. It resolved: a blaze of violet light ahead of him, a broad ring of embers around it. Elsewhere, black.

Peerssa said, "There is something we must discuss."

"Wait a minute. Give me a chance to resume breathing."

Peerssa waited.

Corbell said, "It's over? We lived through that?" "Yes."

"Well done."

"Thank you."

"What's happening now?"

"Firing a reaction drive within the ergosphere of a black hole has driven us dangerously near lightspeed. I am using the ram fields to ward interstellar matter from us. I won't be able to use them as a drive until we can shed some velocity. We will reach the vicinity of Sol in thirteen point eight years, ship's time, unless we overshoot."

"Did we really lose three million years?"

"Yes. Corbell, I must have your opinion. Will the State have collapsed over three million years?"

Corbell laughed a little shakily. "We'll be lucky if there's anything like human beings left. I can't guess what they'll be like. Three million years! I wish there'd been another way to do it." He stood up. He was suddenly ravenous.

Peerssa answered. "I was ordered to preserve your life and the integrity of the ship, but never your convenience. My loyalty is to the State."

Corbell stopped. "What's that supposed to mean?"

"There was another way to use the black hole, once we knew it existed. At midpoint we could have continued to accelerate. We would have spent perhaps eighty years reaching the galactic hub. If we passed near enough to the black hole, its spin would have bent our hyperbolic path back upon itself, though we would still have been well outside the ergosphere. Another eighty years of ship's time would have returned us to Sol, seventy thousand years after your departure."

"You thought of that? And you didn't do it?"

"Corbell, I have no data on the nature of water empires. I had to take your word entirely."

"What are you talking about?"

His answer came in Corbell's recorded voice. "I think the State could last seventy thousand years. See, these water empires, they don't collapse. They can rot from within, to the point where a single push from the barbarians outside can topple them. But it takes that push. There's no revolution in a water empire."

Corbell said, "I don't-"

"A water empire can grow so feeble that a single barbarian horde can topple it. But Peerssa, the State doesn't have any outside."

"-I don't understand."

"The state could last seventy thousand years or more, because all of humanity was part of the state. There were no barbarian hordes waiting hungrily for the State to show weakness. The State could have grown feeble beyond any precedent, feeble enough to fall before the hatred of a single barbarian. You, Corbell. You."

"Me."

"Did you exaggerate the situation? I thought of that, but I couldn't risk it, and I couldn't ask."

He's a computer. Perfect memory, rigid logic, no judgement. I forgot. I talked to him like a human being, and now—"You have heroically saved the State from me, I'll be damned."

"Was the danger unreal? I couldn't ask. You might

have lied."

"I never wanted to overthrow the damn government. All I wanted was a normal life. I was only forty-four years old! I didn't want to die!" "You could never have had what you called a normal life. It was already impossible in twenty-one ninety. Corbell could have lived a normal life by dying of cancer."

"I just didn't . . . didn't see it."

"I hoped you would accept the cloning method. I could have used the computer link to alter the clone's attitudes."

"Shut up."

Silence.

"I just don't want to talk for awhile, okay? Just take me home."

Introduction:

Jerry Pournelle and I are both out to save the world, though truthfully Jerry is far more aggressive about it; my role is more along the (side)lines of "Yeah, you tell 'em! And how about adding . . ." I have this relationship with several authors, but with no other nearly so intensely as with the redoubtable Dr. Pournelle.

In one of our innumerable conversations that veer pleasantly between state-of-the-art and state-ofthe-world I opined that it was maddening to watch and listen to practically everyone chanting in unison "The sky is falling, Doom-Doom-Doom!" and that science and technology have led us to a dark and noisome place from which there is no returning, except, maube, via the neolithic.

"We have to prove not only that technology offers hope for a viable future, but that only technology offers that hope. What we need is a plan—"
"A Blueprint—" I broke in.

"Yes, 'A Blueprint for Survival!'" he finished.

And so was born Part I of a three-part article. Part II was "Survival with Style." Part III you are about to read. We can get there from here. We can.

THAT BUCK ROGERS STUFF

by Jerry Pournelle

THE YOUNG LADY was very serious, and although I might have wished that she looked like an ogre with raucous voice, and nose and chin meeting in front of her lips, she was actually very professional in appearance, highly attractive, and according to most objective standards, intelligent. My wife and I had come to a typical Los Angeles show-business party, and the young lady had been waiting for me. Before I could get properly into the room she advanced menacingly.

"You write science fiction," she accused. "Escapism. What good does it do to get people dreaming about that Buck Rogers Stuff?" (I swear, it she used that phrase, the same one that countless teachers used in the days of my youth when they caught me reading Astounding Science Fiction.)

Naturally, she had A Cause. "We spent billions for what? For some pieces of rock and pretty pictures on television! And there are millions out of jobs, we need better schools, and—"

Readers have probably had similar experiences and can finish off the speech for themselves. It's not the only time I've been put to The Question: "Why throw money away on space when there's so much that needs doing here on Earth?" All right, let's talk about space and see just how far we can get.

First, for a really beautiful job of presenting what we've already got out of space, see the NASA SPINOFF documents; they print another each year, and they tell what new economic impact space research has had on American lives.

The SPINOFF documents are written by Neil Ruzic, who's also the author of an excellent book on the future uses of the Moon called WHERE THE WINDS SLEEP. Between the SPINOFF annuals and Ruzic's book you can find plenty of answers to the silly question about why we should spend money on space.

In fact, the problem is knowing where to begin. Weather predictions? Remember when the weatherman was a joke? Now true, the Weather Bureau makes some mistakes even yet; but not very many, and almost never when it comes to hurricanes. You can show that the space program has pretty well paid for itself just in better weather forecasting alone.

Those concerned about pollution will be pleased to hear that Earthwatch satellites finally give us a chance to see the real effects of pollution. Mining prospecting has been revolutionized by satellite photography. The international Food and Agricultural Organization in Rome can, from satellite data, get a good forecast of famine areas and global food production.

That's all satellite stuff. Industry benefits are nearly incalculable, and I don't mean frivolities like Teflon frying pans. Test procedures and quality control: the inspection methods developed for manrating spacecraft and boosters are now routinely used in building better plows, tractors, automobiles, skis, hiking boots and packframes, electronic equipment, and darned near anything else you can think of.

In my early days in the space program one of the hardest jobs we had was monitoring physiological conditions in a stress environment. Just getting an ordinary electro-cardiograph (EKG) through a pressure wall required great ingenuity. We invented a number of such devices; we had to. My own inventions are long since obsolete—but the space medicine technology that grew out of our early efforts is routinely used in hospitals and clinics all over the world. Mass spectrometers to analyze exhaled breath; microminiature EKG systems worn by hospital patients and displaying abnormalities to the duty nurse; blood analysis equipment; even heart condition diagnosis from moving vehicles; all routine, and all developed as part of the NASA package.

Your tires last longer, you can buy large fiberglass structures, firemen can keep your house from burning, your electrical system is simpler, crash helmets work better (remind me sometime to tell you about the purchase order for "nine freshly-killed human male corpses, ages 21 to 40 at time of death, must not have any abnormalities of brain or upper spine; expendable research item; no salvage value." The Purchasing Officer's reaction to that was, uh, interesting); driver-training simulators work, paint lasts longer, and golf clubs do a better job of driving the ball.

"Whoa. That's all technology, and technology is evil. It causes pollution, and kills people in wars,

and—"

And at that point my usual reaction is a loud "Aaargh!" and a burning desire to find a drink. Quickly. Especially when it was said by a young person wearing a thin wristwatch and polyester imitations of honest blue denim, driving a Mercedes, and feeling committed because he hasn't eaten table

grapes for weeks. I should control that reaction, of course; but if I were able to do that I'd probably still be in aerospace management instead of living the unnatural life of a writer.

Still, such people ought to be answered; our whole future may depend on it. Let's try.

California's Governor Jerry Brown has built himself quite a reputation by pushing "Alternate Technology" and the philosophy that goes with it. "Make do. Expect less. Conserve. Smaller is better. Recycle. Be satisfied with what you have. There's Only One Earth."

Now there are some attractive points about all that. Moreover, the vision of a stable, low-to-zero-growth economy, concentrating on adventures of the mind, with a lot of "cottage industry" can be a noble one. It's probably possible, too—for us, and for a while.

It is not a philosophy likely to appeal to the poor of this world. Like it or not, a conservation-oriented low-growth world economy dooms most of the world's people to wretched poverty. But what has that to do with us? Can we not, ourselves, change our ways and let others go theirs?

Probably not. Like it or not, we've got most of the technology—and we don't have enough to develop the Earth to a point of satiation. If all the world gets rich through the same wasteful processes we employed, we're probably in big trouble. Worse, what of our grandchildren? The Earth's resources will not last forever; and what then?

I've argued here before that this generation is crucial: we have the resources to get mankind off this planet. If we don't do it, we may soon be facing a

world of 15 billion people and more, a world in which it's all we can do to stay alive; a world without the investment resources to go into space and get rich. Usually I think it won't come to that; it's only in odd moments—s ich as when faced with The Question—that I get depressed.

I don't think it will come to that, because the

vision of the future is so clear to me.

We need realize only one thing: we do not inhabit "Only One Earth."

Mankind doesn't live on Earth. Man lives in a solar system of nine planets, 34 moons, and over half a million asteroids. That system circles a rather small and unimportant star that is part of a galaxy containing tens of billion of stars. Only One Earth, indeed! There are millions of Earths out there, and if we use up this one, we'll just have to go find another, that's all.

We needn't use up this one. In a previous chapter I went through the numbers: how we can, with present-day technology, deliver here to Earth as much metal for each person in the world as the US disposed of per capita in the 60's. We can do that without polluting our planet at all, and we can keep it up for tens of thousands of years. The metal is out there in the asteroid belt. For starters we don't even have to look very hard; most of the asteroids were once spherical, large enough to have metallic cores, and now the worthless gubbage topside has been knocked away, exposing all that lovely iron and lead and tin and such we'll need to give the wretched of the Earth real freedom.

Why not? The refinery power's there; the Sun gives it off for free. We have a propulsion system to get us to the asteroids; Project NERVA was can-

celled, but the research was done, and it wouldn't be that hard to start up again. Nuclear-powered rockets would be rather simple to build, if we wanted them.

But first we'll need a Moonbase. We can get that the hard way, carrying stuff up bit by bit from the top of disintegrating totem poles, but there are easier ways.

We could do it in one whack. Project ORION was also cancelled, but we could build old Bang-Bang in a very few years if we wanted to. ORION used the simplest and most efficient method of nuclear propulsion of all: take a BIG plate, quite thick and hard; attach by shock-absorbers a large space-going capsule to it; put underneath one each atomic bomb; and fire away.

Believe me, your ship will move. When you've used up the momentum imparted by the first bomb, fling another down underneath. Repeat as required. For the expenditure of a small part of the world's nuclear weapon stockpile you have put several million pounds into orbit, or on the Lunar surface.

But that will cause fallout.

Yes; some. Not very much, compared to what we have already added to background radiation, but perhaps enough that we don't want to use ORION—although, he said happily, ORION is one reason why I think we'll eventually do what has to be done, even if this generation fails in its duties to the future. ORION is cheap and the bombs won't go away; if we're still alive in that grim world of 15-20 billion and no space program, somebody's going to revive Bang-Bang and get out there.

ORION gets a few big payloads to orbit or the Moon. A more systematic way would be to build a big laser launching system and make it accessible to

anyone with a payload to put into orbit. Freeman Dyson calls laser launch systems "space highways." The government builds the launch system, and can use it for its own purposes; but it also gives private citizens, consortiums, firms, a means of reaching orbit.

Dyson envisions a time when individual families can buy a space capsule and, once Out There, do as they like: settle on the Moon, stay in orbit, go find an asteroid; whatever. It will be a while before we can build cheap, self-contained space capsules operable by the likes of you and me; but it may not be anywhere near as long as you think.

The problem is the engines, of course; there's nothing else in the space home economy that couldn't, at least in theory, be built for about the cost of a family home, car and recreational vehicle. But then most land-based prefabicated homes don't have their own motive power either; they have to hire a truck for towing.

It could make quite a picture: a train of space capsules departing Earth orbit for Ceres and points outward, towed by a ship something like the one I described in "Tinker." Not quite Ward Bond in "Wagon Train," but it still could make a good TV series. The capsules don't have to be totally self-sufficient, of course. It's easy enough to imagine way stations along the route, the space equivalent of filling stations in various orbits.

Dyson is fond of saying that the US wasn't settled by a big government settlement program, but by individuals and families who often had little more than courage and determination when they started. Perhaps that dream of the ultimate in freedom is too visionary; but if so, it isn't because the technology won't exist. However we build our Moonbase, it's a very short step from there to asteroid mines. Obviously the Moon is in Earth orbit; with the shallow Lunar gravity well it's no trick at all to get away from the Moon, and Earth orbit is halfway to anywhere in the solar system. We don't know what minerals will be available on the Moon. Probably it will take a while before it gets too expensive to dig them up, but as soon as it does, the Lunatics themselves will want to go mine the asteroids.

There's probably more water ice in the Belt than there is on Luna, so for starters there will be water prospectors moving about among the asteroids. The same technology that sends water to Luna will send metals to Earth orbit. I've already described one ship that can do the job. There are others. The boron fusion-fission process is a good example.

Take boron-11 (11Bs). Bombard with protons. The result is a complex reaction that ends with helium and no nuclear particles. It could be a direct spacedrive. For those interested, the basic equation is

 $^{11}B_5 + p = 3(^{4}He_2) + 16MeV$

and 16 million electron volts gives pretty energetic helium. The exhaust velocity is better than 10,000 kilometers/second, giving a theoretical specific impulse ($I_{\rm sp}$) of something over a million. For comparison the $I_{\rm sp}$ of our best chemical rockets is about 400, and NERVA manages something like 1200. The boron drive needn't be used very efficiently to send ships all over the solar system.

Meanwhile, NERVA or the fission-ion drive I described in an earlier column will do the job. In fact, it's as simple to get refined metals from the asteroid belt to near-Earth orbit as it is to bring them down from the Lunar surface. It takes longer, but

who cares? If I can promise GM steel at less than they're now paying, they'll be glad to sign a "futures" contract, payment on delivery.

It's going to be colorful out in the Belt, with huge mirrors boiling out chunks from mile-round rocks, big refinery ships moving from rock to rock; mining towns, boomtowns, and probably travelling entertainment vessels. Perhaps a few scenes from the wild west? "Claim jumpers! Grab your rifle—"

Thus from the first Moonbase we'll move rapidly,

Thus from the first Moonbase we'll move rapidly, first to establish other Moon colonies (the Moon's a big place) and out to the asteroid belt. After that we'll have fundamental decisions to make.

We can either build O'Neill colonies or stay with planets and Moons. I suspect we'll do both. While one group starts constructing flying city-states at the Earth-Moon Trojan Points, another will decide to make do with Mars.

Mars and Venus aren't terribly comfortable places; in fact, you probably won't want to land on Venus at all until it has been terraformed. Between Mars and Venus, Venus is the easier to make into a shirt-sleeves-inhabitable world. It requires only biological packages and some fertilizers and nutrients, and can be done from Moonbase or, in a pinch, from Earth itself. Still, though Venus may be the simpler job, Mars is likely to come first, simply because you can live there before terraforming; there will be dome colonies on the Red Planet.

I wrote a story ("Birth of Fire") describing one Mars-terraforming project: melt the polar caps and activate a number of Martian volcanoes to get an atmosphere built up. Isaac Asimov described the final step many years ago: get your ice from Out There, at Jupiter or Saturn, and fling it downhill to Mars. Freeman Dyson points out that there's enough ice on Enceladus (a Saturnian moon) to keep the Martian climate warm for 10,000 years. The deserts of Mars can become gardens in less than a century.

Dyson's scheme didn't even involve human activity on Enceladus; robots and modern computers could probably accomplish the job. They've only to construct some big catapults on the surface of Enceladus, and build some solar sails. Dyson suggests robots because the project as described would take a long time, and human supervisors might not care for the work; but I suspect we could get plenty of volunteers if we needed them. Why not? No one could complain that the work was trivial, and you couldn't ask for an apartment with a better view than Saturn's Rings!

Moonbases. Lunar cities. Mining communities in the asteroid belt. Domed colonies on Mars, with prospects for terraforming the planet and turning it into a paradise. An advanced engineering project headquarters on Enceladus. Pollution controlled on Earth, because most polluting activities would go on in space. Near-Earth space factories. Several to hundreds of city-states at the Trojan Points of the Earth-Moon system. A space population of millions, with manned and unmanned ships stitching all the space habitats together. This is not a dream world; this is a world we could make in a hundred years!

In 1872 a number of Kiowa and Comanche chiefs were taken to Washington by Quakers in an attempt to show the Indians just what they were facing. When they returned to talk about the huge cities, and "a stone tipi so large that all the Kiowa could sit under it," they were not believed. One suspects that if the Quaker schoolmasters had been magically

transported to the Washington of 1979 and then returned to their own time, they would not be believed either. A nation of over 200 million people? Millions of tons of concrete poured into gigantic highways? Aircraft larger than the biggest sailing ships? City streets brightly lit at night? Millions of tons of steel, farmlands from Kansas to California.

Building a space civilization in the next hundred years will be simpler than getting where we are from 1879. We already know how to do it. We probably don't know how we will do it; certainly the very act of space exploration will generate new ideas and techniques as alien to us as nuclear energy would have been to Lord Rutherford or Benjamin Franklin; but we already know how we could do it. No basic new discoveries necessary.

In the 1940's I did a class report on space travel. I drew heavily from Astounding, from Heinlein's Future History, from Willy Ley's books on rockets and space travel (and certainly never thought I would someday be science columnist in the same magazine as Willy). My teachers were tolerant. They let me do it. They didn't believe in suppressing their pupils. Afterwards, though, the physics teacher called me in for a conference: I should learn some good basic science, and get my head out of the clouds. That Buck Rogers Stuff was fine for amusement—he read it himself—but in the real world.

In the real world I got a letter from that teacher, who had the honesty to send a note in August, 1969, apologizing to me and expressing gratitude that he'd not been able to discourage me from those crazy dreams. I wish he were alive so I could find out his reaction to *this* chapter.

It's not crazy dreams. It's not even Far Out. It's

only basic engineering, and some economics, and a bit of hope. I may even have been too conservative. It probably won't take a hundred years.

Given the basic space civilization I've described, we'll have accomplished one goal: no single accident, no war, no one insane action will finish us off. We won't have to have outgrown our damn foolishness to insure survival of the race. Perhaps we'll all be adults, mature, satisfied with what we have, long past wars and conflicts and the like; but I doubt it. At least, though, there will be no way to exterminate mankind, even if we manage to make the Earth uninhabitable; and it's unlikely that any group, nation, or ideology can enslave everyone. That's Worth Something.

One suspects, too, that there will be an enormous diversity of cultures. Travel times between various city-states—asteroid, Martian, Lunar, O'Neill colony Saturnian forward base, Jovian Trojan Point—will be weeks to months to years with presently foreseeable technology. That's likely to change, but by the time the faster travel systems are in widespread use the cultural diversities will be established. Meanwhile, communication among all the various parts of the solar system will be simple and relatively cheap, so that there will have been that unifying influence; cultures will become different because people want to be different, not because they don't know any better.

OK. In 100 years we'll have built a space civilization. We'll no longer have really grinding poverty, although there will undoubtedly be people who consider themselves poor, just as we have today people who live better than the aristocrats of 1776, but who think themselves in terrible straits. We'll have insured against any man-made disaster wiping out the

race. What's next besides more of the same?

Why, we haven't even got started yet! "Be fruitful and multiply, and fill the face of the Earth," said the command; soon that will have been done; and some day we'll even run up against a filled solar system.

The first step is obvious. We can begin taking some of the more useless planets apart. They've got all that lovely mass, and it's concentrated so that we can't use it; better to make proper use of, say, Jupiter, and Mercury, and someday perhaps even Mars and Venus despite our having terraformed them.

At a thousand tons of mass per person, Mercury, taken apart, could provide living space for 3 x 10²⁰ people—that's 300 billion billion, rather a large population. People in the US at present dispose of about 10¹⁸ ergs per capita each year; small potatoes for a space civilization. Let's figure that our space people will need a million times that much, 10²⁴ ergs per each per year, or a total of 3 x 10⁴⁴ ergs for the people living on the skeleton of Mercury.

It's too much. The Sun only puts out 2 x 10³⁹ ergs each year, and we can't catch all that. It seems we'll run out of energy before we run out of mass, and that's handy. Back to energy conservation! To support a really large population, though, we'll have to destroy some matter. Obviously that can't go on forever: so, while we're destroying matter, we may as well go elsewhere.

The stay-at-homes will busily take planets apart for their mass, and so fill space with flying cities that they'll soon catch great quantities of solar energy. You can just hear the asteroid civilizations (what's left of them) complaining about those closer in taking up all the light. Perhaps the Rockrats will be the first to say the Hell with it and leave, looking for a place to live where there's elbow room. Just too

crowded in the solar system. "Not like when I was a kid, Martha. Not room to swing a cat nowadays."

They can take their whole civilization with them. The negotiations may take some time; the homebodies aren't going to want to let all that nice matter leave the system forever. Perhaps the Rockrats will promise to send back a nice fat planet from wherever they're going. It will take a while to pay off the debt, but they can pay it back with very high interest.

The trip will take many years, but so what? The Rockrats have taken their civilization with them. They'll miss the Sun, and by the time they arrive they'll have used up most of their asteroid, but by then people will live long lifetimes—and they'll darned well know how to exploit the new stellar system. "We'll do it right, Marthal None of those upstart places like Freedonial"

Of course they'll already know about the planets in their new system. There's no real limit to the size of telescope you can build in space, and no problem about seeing; and with the lengthy baseline of the orbit of Ceres, or Jupiter's Trojans, or a Saturnian moon, astronomers will long since have discovered all the planets of all the nearby stars. There will probably have been probes sending back high-resolution pictures and making certain our colonists aren't heading for an already-occupied system.

And so it goes; across the Galaxy, as mankind fills system after system, and somebody begins to feel crowded. You'll note I haven't even postulated faster-than-light travel; I have given us matter annihilation, although that's not strictly necessary.

And beyond that? When we've tapped all the resources of easily available planets, and are still running out of metals and just plain mass? Well,

there are stars—

Take an old star. A red giant, perhaps. Useless. No planets left—all consumed in the nova explosion that formed an ordinary star into a red giant. The poor thing is doomed in a few million years anyway; why not hurry it along? When it blows up, it will give off all kinds of useful materials.

Of course the star is a long way from civilization. The minerals could be picked up after the explosion, but maybe there's a better way: bring your planet-sized spacecraft reasonably near the target star. Turn on the matter annihilators and focus the resulting energy into a rather powerful laser beam. Shine it properly on the star. That's what you're going to do to blow it up anyway, but if you're selective enough about it you can turn the star itself into a rocket. Heat up this side, let it spew out starstuff, and it will move. Granted that's a slow process, and perhaps there'll be no economic incentive; but stranger things have happened in history. After all, the expedition will save its parent civilization; and life aboard the control planet need not be any more dull than, say, living in a colliery town; or going every day down to work at BBD&O . . .

But we needn't think about moving stars, or travelling to other stellar systems, anymore than Columbus and the Vikings had Cape Canaveral in mind. For the moment we need only concentrate on the next hundred years. There's quite enough to do right here.

In fact, I can just hear it now: "What good does it do to get people dreaming about that Buck Rogers Stuff? Why waste money on interstellar research when there's need for the money right here in the Trojan Points?"

Only One Earth indeed.

Introduction:

Anecdote: When this story was submitted, it contained a Latin quote the second and third words of which had been transposed. An obvious typographical error; I corrected it in the same automatic unthinking fashion in which it had been made. Or so I thought until the story had been printed; then it occurred to me in a blinding flash that in its "misquoted" form that "typo" changed the meaning of the story.

So I called Roger, who relieved me greatly by telling me it had been a typo after all. I am tempted to "restore" that quote to the form submitted originally, but shall refrain.

THE GAME OF BLOOD AND DUST

by Roger Zelazny

THEY DRIFTED TOWARD the Earth, took up stations at its Trojan points.

They regarded the world, its two and a half billions of people, their cities, their devices.

After a time, the inhabitant of the forward point spoke:

"I am satisfied."

There was a long pause, then, "It will do," said the other, fetching up some strontium-90.

Their awareness met above the metal.

"Go ahead," said the one who had brought it.

The other insulated it from Time, provided antipodal pathways, addressed the inhabitant of the trailing point: "Select."
"That one."

The other released the stasis. Simultaneously, they became aware that the first radioactive decay particle emitted fled by way of the opposing path.

"I acknowledge the loss. Choose."

"I am Dust." said the inhabitant of the forward

point. "Three moves apiece."
"And I am Blood," answered the other. "Three moves. Acknowledged."

"I choose to go first."

"I follow you. Acknowledged."

They removed themselves from the temporal sequence and regarded the history of the world.

Then Dust dropped into the Paleolithic and raised and uncovered metal deposits across the south of Europe.

"Move one completed."

Blood considered for a timeless time then moved to the second century B.C. and induced extensive lesions in the carotids of Marcus Porcius Cato where he stood in the Roman Senate, moments away from another "Carthago delenda est."

"Move one completed."

Dust entered the fourth century A.D. and injected an air bubble into the bloodstream of the sleeping Julius Ambrosius, the Lion of Mithra.

"Move two completed."

Blood moved to eighth century Damascus and did the same to Abou Iskafar, in the room where he carved curling alphabets from small, hard blocks of wood.

"Move two completed."

Dust contemplated the play.

"Subtle move, that."

"Thank you."

"But not good enough, I feel. Observe."

Dust moved to seventeenth century England and, on the morning before the search, removed from his laboratory all traces of the forbidden chemical experiments which had cost Isaac Newton his life.

"Move three completed."

"Good move. But I think I've got you."

Blood dropped to early nineteenth century England and disposed of Charles Babbage.

"Move three completed."

Both rested, studying the positions.

"Ready?" said Blood.

"Yes."

They reentered the sequence of temporality at the point they had departed.

It took but an instant. It moved like the cracking of

a whip below them . . .

They departed the sequence once more, to study the separate effects of their moves now that the general result was known. They observed:

The south of Europe flourished. Rome was founded and grew in power several centuries sooner than had previously been the case. Greece was conquered before the flame of Athens burned with its greatest intensity. With the death of Cato the Elder the final Punic War was postponed. Carthage also continued to grow, extending her empire far to the east and the south. The death of Julius Ambrosius aborted the Mithraist revival and Christianity became the state religion in Rome. The Carthaginians spread their power throughout the middle east. Mithraism was acknowledged as their state religion. The clash did not occur until the fifth century. Carthage itself was destroyed, the westward limits of its empire pushed back to Alexandria. Fifty years later, the Pope called for a crusade. These occurred with some regularity for the next century and a quarter, further fragmenting the Cathaginian empire while sapping the enormous bureaucracy which had grown up in Italy. The fighting fell off, ceased, the lines were drawn, an economic depression swept the Mediterranean area. Outlying districts grumbled over taxes and conscription, revolted. The general anarchy which followed the wars of secession settled down into a dark age reminiscent of that in the initial undisturbed sequence. Off in Asia Minor, the printing press was not developed.

"Stalemate till then, anyway," said Blood.

"Yes, but look what Newton did."

"How could you have known?"

"That is the difference between a good player and an inspired player. I saw his potential even when he was fooling around with alchemy. Look what he did for their science, single-handed—everything! Your next move was too late and too weak."

"Yes. I thought I might still kill their computers by destroying the founder of International Difference Machines, Ltd."

Dust chuckled.

"That was indeed ironic. Instead of an IDM 120, the *Beagle* took along a young naturalist named Darwin."

Blood glanced along to the end of the sequence where the radioactive dust was scattered across a lifeless globe.

"But it was not the science that did it, or the

religion."

"Of course not," said Dust. "It is all a matter of emphasis."

"You were lucky. I want a rematch."

"All right. I will even give you your choice: Blood or Dust?"

"I'll stick with Blood."

"Very well. Winner elects to go first. Excuse me."

DUST MOVED to second century Rome and healed the carotid lesions which had produced Cato's cerebral hemorrhage.

"Move one completed."

Blood entered eastern Germany in the sixteenth century and induced identical lesions in the Vatican assassin who had slain Martin Luther.

"Move one completed."

"You are skipping pretty far along."

"It is all a matter of emphasis."

"Truer and truer. Very well. You saved Luther. I will save Babbage. Excuse me."

An instantless instant later Dust had returned.

"Move two completed."

Blood studied the play area with extreme con-

centration. Then, "All right."

Blood entered Chevvy's Theater on the evening in 1865 when the disgruntled actor had taken a shot at the President of the United States. Delicately altering the course of the bullet in midair, he made it reach its target.

"Move two completed."

"I believe that you are bluffing," said Dust. "You could not have worked out all the ramifications."

"Wait and see."

Dust regarded the area with intense scrutiny.

"All right, then. You killed a president. I am going to save one—or at least prolong his life somewhat. I want Woodrow Wilson to see that combine of nations founded. Its failure will mean more than if it had never been—and it will fail.—Excuse me."

Dust entered the twentieth century and did some repair work within the long-jawed man.

"Move three completed."

"Then I, too, shall save one."

Blood entered the century at a farther point and assured the failure of Leon Nozdrev, the man who had assassinated Nikita Kruschev.

"Move three completed."

"Ready, then?"

"Ready."

They reentered the sequence. The long whip cracked. Radio noises hummed about them. Satellites orbitted the world. Highways webbed the continents. Dusty cities held their points of power throughout. Ships clove the seas. Jets slid through the atmosphere. Grass grew. Birds migrated. Fishes nibbled.

Blood chuckled.

"You have to admit it was very close," said Dust.

"As you were saying, there is a difference between a good player and an inspired player."

"You were lucky, too." Blood chuckled again.

They regarded the world, its two and a half billions of people, their cities, their devices . . .

After a time, the inhabitant of the forward point spoke:

"Best two out of three?"

"All right. I am Blood. I go first."

". . . And I am Dust. I follow you."

Introduction:

As I began The Best of My Years with an editorial, let me so end it, even though I have since amended one opinion expressed in it: Science fiction is not facing a crisis that it may not survive. Rather it is facing a challenge that it may never meet quite successfully. But a lot of people are trying to meet it now, and in the process creating some of the best of the world will ever see. This is the Golden Age.

GALAXY and the GALAXY by James Baen

IN THE PAST four years or so something on the order of twenty thousand manuscripts have passed through my hands. After the first few thousand I became suspicious. After ten thousand the suspicion thickened. Now, after twenty thousand manuscripts I am certain: science fiction, as a growing, conceptually vital field, is in a state of crisis, a crisis of ideas, a crisis that it may not survive.

Oh, as a minor, formula-oriented literary subgenre—or sub-literary genre—it is secure enough. More people than ever seem to be reading it; the moguls of television and Hollywood are beginning to take a serious interest. But where are the new ideas? In television? The movies? The formula in those honorable media seems to be to take some antique theme from the 40's or 50's—adventures aboard the crippled, multi-generation colony ship that will forever wander aimlessly between the stars, or aboard the FTL vessel that has slipped into a "space warp" and is Lost In Space—and adapt it. Adaptation meaning in this case to bastardize, prostitute, mindlessly oversimplify, and otherwise make suitable for the moguls' conception of the massmentality what was initially in honest if somewhat bewhiskered science fictional conception. Even the many new readers (long may they prosper!) are mostly interested in what science fiction has been, not what it is becoming.

And who can blame them? What little there is in

the way of originality in modern science fiction consists in the main of variations on the theme of human misery. Misery without end—an all-embracing, open-ended misery that is almost admirable in its single-minded affirmation that the game of life is fixed: that you've got to play; that you can't win; and that in every possible aspect of its potentially infinite variation, now and forever, the playing itself must be a miserable experience, filled with pain, devoid of joy. An affirmation, in other words, that it is better to be dead than to be alive.

Is it any wonder, then, that the latest re-issue of The City and the Stars is selling like hotcakes? Or that the Foundation Trilogy is in its umpteenth printing? Hardly. People—even intelligent people—can be told only so many times that life by definition is a bucket of sewage with the handle inside, firmly affixed to the bottom of the bucket, before they wander off to look for the latest Asimov or Heinlein reissue, even if it is Lucky Star and the Pirates of the Asteroids, or Have Spacesuit—Will Travel. I've done it myself.

Are there then no glorious new conceptions equivalent for the 70's and 80's of what space travel and extraterrestrial intelligence were for an earlier time? Have we indeed run out of ideas? Is there nothing left but infinite variations on a strictly limited number of antique themes, the mental poverty being at best obscured under the guise of literary experimentation?

For a while I thought that that might indeed be the case, but I have since concluded that far from there being too few ideas, there are too many, and that taken together, as they must be, they offer, insist upon, a "universe of discourse" so varied and vast in scope that it defies the imagination and perhaps even (dare I say it?) the intelligence of the best of us, even unto our science fiction writers, brilliant as they all undoubtedly are.

Indeed, it may well be the case that the reason, the real reason, for the nearly universal nihilism in modern sf—sf that is not merely a rehashing of old themes—is that the ramifications of assuming continued progress in science and technology are simply too difficult to conceive, that such future vistas are simply too vast to be grasped.

So where are all these ideas that I claim are being willfully ignored? The same place they always were: in the writings of scientists and their popularizers. Virtually every area of science is pregnant with major, high-social-impact developments, developments that are not, many of them, "looming on the horizon," but are literally waiting for funding.

Space: Microwave-powered stellar probes; O'Neill colonies; asteroid mining; orbital powergenerating stations; planetary engineering (Venus, in particular, is ripe for the plucking).

Biology: Recombinant DNA research (maybe that should wait on the availability of orbital laboratories); "btu bushes," plants capable of harvesting ten or twenty percent of the sunlight that falls on them; a cloned work force of semi-intelligent simians that are bred for happiness, docility—and manual labor; biological sewage systems capable of reharvesting, with the aid of sunlight, everything that is dumped into them.

Cybernetics: Artificial Intelligence (called "A.I." by those in the field); "hand calculators" that by virtue of being mobile extensions of giant computers (see "Artificial Intelligence") have available to them

the sum total of human knowledge and computational capacity, devices that would make all but the dullest of us hyper-intelligent and almost omniscient.

The list is endless; the available grist for the science fictional mill is virtually infinite, both in variety and quantity.

But there is a kicker: it's all or nothing. The writer cannot just go to the idea shelf, posit one that he likes, and proceed to examine its implications in isolation from all the rest. If any of them happen, they all happen, or at least a very large number of them do. There will be no O'Neill colonies without plentiful power, without asteroid mining giving us a super abundance of minerals, without amplified human intelligence, without, without everything.

That's part of the problem. It gets worse: each one of these developments is but the tip of a conceptual iceberg of further developments and applications.

Take the laser, for one example. At first it was an interesting gadget useful for measuring distant objects and cutting close ones in a spectacular manner, with maybe distant applications as a communications device. Now it is, or soon will be, a space propulsion system, a surgical tool, the heart of an anti-ballistic missile system, a "science fiction death-ray," and who knows what else.

The same is true for all the developments now pending. Let's take just one of them and follow its ramifications as far as imagination fortified by a few calculations will take us.

The O'Neill colonies: assume that they are feasible. Assuming that, you have also assumed that they are pretty much, in the long run at least, resource-independent of earth—that they can grow their own

food from raw materials of extra-terrestrial origin, and that they have manufacturing capacity such that they are capable of self-replication (which latter capacity they will possess almost by definition; the first colonies will, after all, have virtually built themselves).

What, then, would be the "limits of growth" for such colonies? Other than human procreativity the only limiting factor I can come up with is the mass (which would come into play long before available sunpower—the famous "Dyson Limit"—would become a factor). In other words, conservatively speaking, the potential "mass" of humanity would seem to be limited only by the present mass of the solar system's asteroids, moons and smaller planets—and I suspect that when they are needed the means will be available for plucking the gas giants as well.

Note, please, that we are not talking here of some unimaginably distant, million-years-hence future; in terms of the already elapsed lifetime of our species the urbanization of the solar system is but an eyeblink away. Even in the short term the figures are startling.

Starting with a core population of fifty thousand colonists in the Year 2000, by 2250 there will be more people in space than presently reside on this planet. By the Year 2600 there will be a trillion, far more than earth could possibly hold. Before the fourth millennium has run its course, a quadrillion—and population pressure will begin to be such that the more adventurous will have headed for the stars, in perfect indifference as to whether such stars have "earth-like" planets, so long as there is mass available. The Great Exodus will have begun.

Assuming a propulsion system capable of attaining a velocity one-tenth that of light (.1 c or 30,000 km./sec.), in a few million years it will be over. The galaxy will belong to humanity . . . or will it be over? Perhaps the yawning gulfs between the galaxies will not seem so unbridgeable by then.

Ok. That's as far as I can go with space colonies. Now add intelligence amplification (is it a person or a machine—only the composite entity knows for sure). Artificial intelligence. Inevitable contact with non-human intelligences (if we can't find them, we'll breed them). A thousand other things. Now mix them all together—and don't forget that they will all interact on each other and on us in infinitely complex fashion, and at an ever-accelerating pace.

Now add at least one fundamental development on a par with lasers and space colonies that has not yet been conceived; any story pretending to deal with the future that does not have at least one such is mere fantasy.

Now write me a story that takes all of this at least implicitly into account.

Clearly our future, if we have one at all, is so complex as to seem beyond mortal comprehension: what then of fictional portrayal of that future? Who among us can take this kaleidoscope of ever shifting, unending, always interacting and evolving marvels and fix it in his mental grasp? Can anyone? As a science-fiction editor I can only hope that one of you out there will prove to me that it can be done.

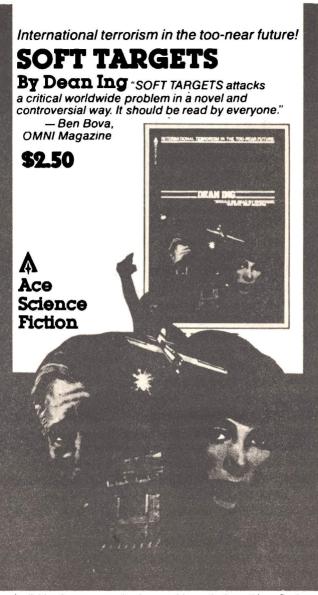


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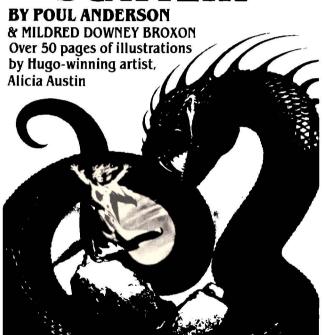
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