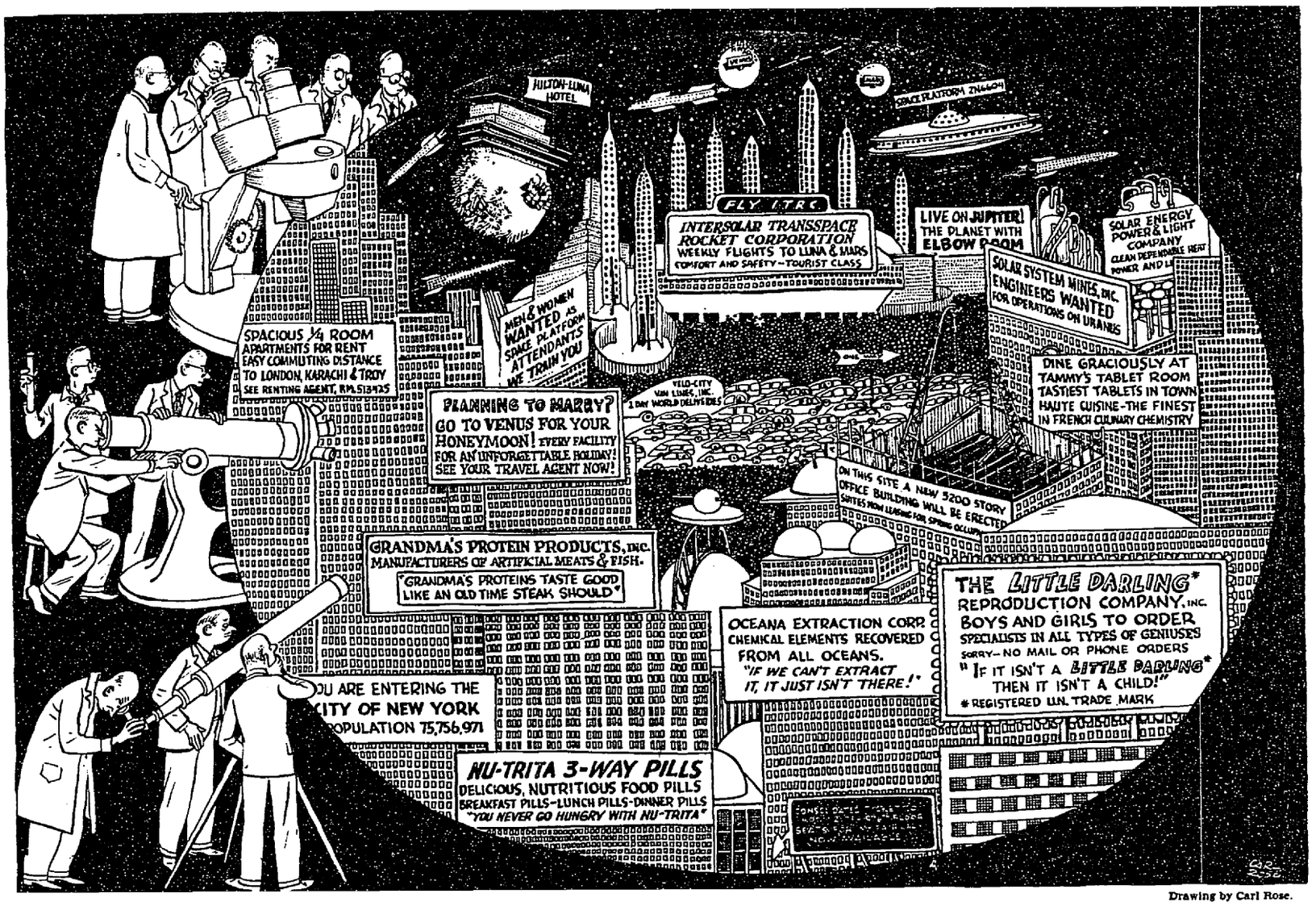

Drawing by Carl Rose.

In the twenty-first century—As science sees it, the outlook for man includes controlled heredity and vacations in the cosmos—but he will still have to eat.

Science Looks at Life in 2057 A. D.

A geneticist, a rocket expert, a biologist, two chemists and a psychologist peer into the future and find it generally good—provided mankind survives that long.

What is in store for man, in view of the enormous forward strides science is making? Not long ago, in New York, a panel of outstanding scientists offered their answers, projecting themselves a century into the future in a symposium on "The Next Hundred Years." The occasion was the centennial celebration of Joseph E. Seagram & Sons, Inc. Below are excerpts from some of the scientists' forecasts.

'PREDICTABLE PROGENY'

PROVIDED that the world does not fall prey to one of the four dangers of our times—war, dictatorship of any kind, overpopulation or fanaticism—the coming one hundred years will revolutionize advances in sciences and their application. For example, it will become possible to bring the reproductive cycle under regulation, to prescribe the sex of the child and to produce at will twins either identical or fraternal, or still more multiple births.

The prevention of overpopulation can occur only by the widespread acceptance of the philosophy that the number of offspring to be produced should be voluntarily restricted for the good of the offspring themselves. With this more ethical attitude concerning reproduction, it will also be regarded as a social obligation to bring into the world human beings as favorably equipped by nature as possible, rather than those who simply mirror their parents' peculiarities and weaknesses.

Foster pregnancy, already possible, will be readily achieved and widely welcomed, in addition to natural pregnancy. This will provide the opportunity of bearing a child from the union, brought about under the microscope, of productive cells derived from persons who exemplified the considered ideals of the foster parents.

The reproductive cells will preferably be derived from persons long deceased, to permit a better perspective on their work, relatively free from personal pressures and prejudices. For this purpose banks of frozen reproductive cells, such as we already have today, will be maintained.

Even more predictability concerning the nature of the progeny will be attainable, if desired, by a kind of parthenogenesis. Where offspring now ordinarily have their hereditary material picked in a random way from two different parents, in this case the offspring would obtain his hereditary equipment entirely from one individual with whom he is as genetically identical as if he were an identical twin. This will be accomplished, as is now done, by extracting the nucleus from a human egg and inserting in its place an entire nucleus obtained from a cell of some pre-existing person, chosen on the evidence of the life he or she had led, and his or her drive potentialities.

—DR. HERMAN J. MULLER, *geneticist, Nobel Prize winner, Professor of Zoology, University of Indiana.*

'COSMIC WONDERS'

I BELIEVE the intercontinental ballistic missile is actually merely a humble beginning of much greater things to come.

Let us suppose it is now 2057 A. D. —one hundred years from now. The wonders of the cosmic age have unfolded before the eyes of mankind. Several expeditions have already gone to Mars and Venus and exploratory voyages will have been extended as far as Jupiter and Saturn and their natural satellites.

Voyages to the moon have become commonplace. The surface of the moon has been subdivided into spheres of interest by the scientists of the major powers, and a lot of prospecting, surveying, tunneling and even some actual mining of precious ores and minerals are going on.

AT some particularly scenic spot in the moon, lavish excursion hotels have been established. These are operated by several national space lines for the purpose of attracting more passenger traffic in addition to their main business of hauling commercial cargo. All these places are pressurized and air-conditioned, featuring large picture windows and astral domes to do justice to the magnificent scenery. They run the whole gamut from honeymoon hotels to wide open gambling joints.

Transportation costs to the moon and to the planets have been immensely reduced as a result of the replacement of the early chemically powered rocket ships by ships powered with controlled *(Continued on Page 100)*

Science Looks at Life in 2057 A.D.

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thermonuclear energy. Definite plans are under way for a regular transport system between the earth and the near planets.

The earth, in 2057 A. D., is surrounded by a whole family of artificial satellites, all of them accepted as members in good standing of our solar system. They are in a great variety of sizes, brightness, purposes, nationalities, orbital altitude and orbital inclinations. Some of the satellites, the best moneymakers, have taken over the mailman's job. They receive messages radioed up to them while over one city, country or continent, and play them back while over another.

A FEW such communication satellites will handle the entire volume of private and official communications between all points of the earth which are more than five hundred miles apart. No message will require more than one hour from sender to recipient. Other satellites at various altitudes will serve as television stations for nation-wide and global television. In addition, there will be large manned space stations serving as space terminals for voyages to the moon and the planets.

When, in 1957, one hundred years ago, the world was rudely awakened to the dawn of the cosmic age by the Russians' sputniks, America momentarily was caught napping, and swung into energetic action. It did not take long for most people in this country to realize that there was far more behind the sputniks than the sensational "beep-beep" and the space-ferrying dog. Indeed, was it not all too obvious that the Soviet Union of 1957 looked upon outer space very much as, in the seventeenth and eighteenth centuries, Great Britain looked upon the seas?

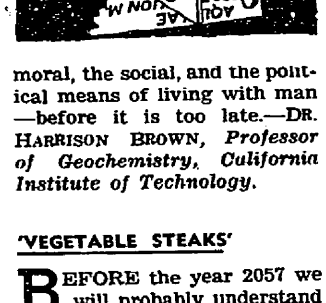
To build a world-wide empire, Britannia then had to rule the waves. To control the great globe itself, the Soviets had to control the space around it. But, fortunately, they didn't make the grade after America, the napping industrial giant, got into the act. Thus, in 2057, the sun still rules over the cosmic age.—DR. WERNHER VON BRAUN, *rocket expert, Director of the Army Ballistic Missile Agency, Huntsville, Ala.*

'GOLDEN AGE'

I CANNOT but believe that the next one hundred years will prove to be more critical than any mankind as a whole has yet been called upon to face. If we survive the next century, and if we are successful in preserving our industrial civilization without becoming robots in the process, then I believe that truly wondrous vistas of our world and of our universe will present themselves in endless sequence.

As our supplies of oil dwindle in this century and coal in the next, we will shift to nuclear power. The world supply of atomic energy is almost inexhaustible. There are large reserves of uranium to start off with and, when these have been consumed, we can, if necessary, obtain uranium from ordinary rock. After that, we have the vast potentialities of thermonuclear power.

A world-wide golden age is truly within our reach. The unknown factors in the equation are not the potentialities of science and technology. The major unknown, I believe, is whether man can devise the



moral, the social, and the political means of living with man—before it is too late.—DR. HARRISON BROWN, *Professor of Geochemistry, California Institute of Technology.*

'VEGETABLE STEAKS'

BEFORE the year 2057 we will probably understand in the most meticulous detail all of the molecular and atomic events that cause living things to live.

It appears to me quite probable, however, that people at this time will still eat food. By this I mean that I consider it unlikely that human beings will take on their supply of energy directly as electrical current or as nuclear power. It is widely held that we will one day replace food with a pill. Perhaps. But if so, I think it will be a big pill. It will be approximately the size of a present-day meal rolled up into a ball. This food will continue to come in the main from green plants, as it does today, from plants that are grown for the purpose by agriculture.

Since there will be several times as many people in the world in a hundred years as there are today, it will be necessary to have, all over the earth's surface, an agriculture that is more intensive than that we now know. Most of the earth's surface will be tilled as intensively as is now done in Japan or Denmark, and to do that we will have to extend our cultivated areas. We will irrigate the deserts with water purified from ocean water. Loss of crops to pests will be long abolished and be just a dim memory.

Farming, of course, will be very highly mechanized and very few people will be directly involved in it. It will be possible, in fact, to program the entire farming operation and leave the farm to run itself from a master computer panel.

Human beings one hundred years from now will be largely vegetarian. As the mass of human flesh increases on the earth's surface, the mass of animal flesh will inexorably decrease. But our vegetarian diet will be a wholly satisfactory one, nutritious, attractive and wholesome. The craft of food technology will have reached a high level. We will, for example, eat steaks made from extracted vegetable protein, flavored with tasty synthetics and made chewy by addition of a suitable plastic matrix.—DR. JAMES BONNER, *Professor of Biology, California Institute of Technology.*

'OUTDOING NATURE'

I WOULD like to pose two questions: What makes the grass green? How do oysters get their copper out of the sea water in which they live?

I am very serious about these questions. They involve the complex details of the most minute chemical mechanisms within the cells of living matter. They lie in the general domain of the biochemist.

The first deals with photosynthesis, which is that process by which plants absorb the energy of sunlight and use it to bring about the energy-absorbing chemical reactions between carbon dioxide and water and a few other materials to form the substances of which plants are made. This process is basic to all living matter, including ourselves.

The chemist happens to know a great deal now about photosynthesis, but much knowledge remains to be acquired. When this subject is mastered, the chemist, aided by the physicist and the chemical engineer, will be able to develop processes of artificial photosynthesis; this will open up the possibility of synthesizing all of our liquid fuel, such as gasoline, not just by imitating, but by outdoing nature.

Taking up the second question, we know that the oyster gets its copper from the sea water in which he lives, and we know that he has concentrations of copper in his blood-like fluid, a few thousandfold greater than in the water which surrounds him.

How does he do this? As far as I know, no one knows the answer. The process is understood in a general sort of a way, but the details still remain a mystery. When that process is understood in detail, then we will be able to improve on nature, and I think it may very well be that we will be able to develop processes for tapping the almost infinite mineral resources of the ocean.

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The questions that I posed are only two of a very great many which fall in the domain of the biochemist. What is the biochemistry involved in the life process itself? What is living matter? How would such knowledge, if we had it, affect the specific cure for cancer, for instance? Almost certainly, there are some biochemical abnormalities involved in mental diseases. What are they? Can those mechanisms be altered? There are many more such unanswered questions.

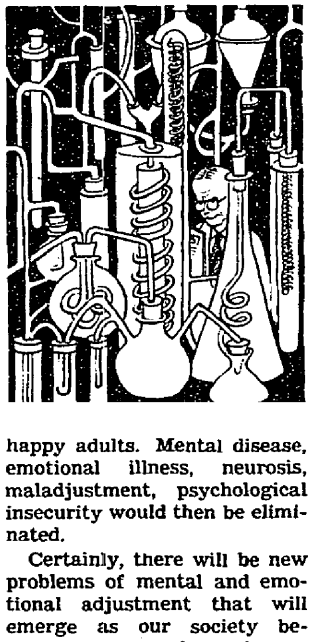
The coming century, in the hands of the biochemist, may very well be the dominant period of progress of the world—*provided* the proponents of the other scientific disciplines, the politicians, the public at large, seriously absorb and use the discoveries which, I am sure, the biochemist, with his colleagues, is going to make.—DR. CLIFFORD C. FURNAS, *chemist, Chancellor of the University of Buffalo.*

'A DELIGHTFUL WORLD'

IF man survives, he can look forward to learning more about himself in the next one hundred years than he has in the preceding one million. He could discover the causes and cures of sicknesses and pain, of hate and destruction. He could come to realize his true biological potentials. He can learn to circumvent many of his limitations. He can learn how to change himself. Conceivably, in another hundred years, the life sciences and social sciences could put man in control of his own destiny.

The chemistry of metabolism and body processes will provide a detailed knowledge of the biochemistry of the central nervous system. It might then be possible to change the environment of the nervous system and thus eliminate disease and malfunction and produce an increased biological efficiency of nerve cells and of the cell network. We would then be able to change emotions, man's desires and thoughts, by biochemical means, as we are now doing, in a rather gross way, with tranquilizers.

THE genesis of human motives, values, feelings and emotions, and the way in which our child-raising procedure influences our development, should be worked out in detail. Then we would know how parents could provide an ideal environment for their children to grow into emotionally secure, self-confident,



happy adults. Mental disease, emotional illness, neurosis, maladjustment, psychological insecurity would then be eliminated.

Certainly, there will be new problems of mental and emotional adjustment that will emerge as our society becomes more complex and more demanding. But these malfunctions should be on a more and more superficial level as we continue to work out the basic principles of human behavior.

THE intellectual output of the brain should be greatly increased. The important principles concerning the thinking processes, as they relate to creative imagination, will be worked out, and the procedure will be so systematized that man should be able to generate creative ideas at will, simultaneously taking into account all possible combinations of known variables.

Educational practices should be radically different. They should depend much less on verbal communication and more on the other senses. Electronic memory banks, complex computers, perhaps even coded electrical information transmitted directly into the nervous system—all of these could accelerate formal education.

I think we might expect parallel advances in uncovering the principles of dynamics; that is, the network of psychological and emotional forces that influence the behavior of people in group and social situations. These principles would tell us how to form groups, how to develop group goals, how to select group leaders, how to reach effective group decisions.

The process by which an aggregate of people becomes a closely knit unit, an integrated team, will be understood. This will enable us to make very rapid social changes, to eliminate the lag in culture, and to develop desirable social organizations in relatively very short spans of time.

And so, man will continue to increase his intellectual resources to meet the demands of the future. If he learns to control himself before he destroys himself, he will find the world a delightful place in which to live.—DR. JOHN WEIR, *Associate Professor of Psychology, California Institute of Technology.*