OUR HEALTH TOMORROW
Bells of Folly

Portrait of a young girl suffering from mental illness by the French painter Odilon Redon (1840-1916). Here the artist has borrowed a traditional theme of the Middle Ages in which tiny "bells of folly" were fixed to a cap symbolizing the mentally ill. But Odilon Redon has infused his work with a tenderness, softness and understanding which reflect the approach to mental disease today.
HEALTH IN THE WORLD OF TOMORROW
By Dr. M.G. Candeau
Director-General of the World Health Organization

FACING THE 21ST CENTURY
(I) Longer life — less sickness
By Jean-Michel van Gindertael

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By Dr. Stanislav Kavka

THE CLICK OF COMPUTERIZED MEDICINE
By Dr. John Anderson

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HOLD'S THE WORLD'S HEALTH?

LETTERS TO THE EDITOR

FROM THE UNESCO NEWSROOM

TREASURES OF WORLD ART (24)
Bells of Folly (Odilon Redon)

Medicine has made greater advances in the last 50 years than in all its previous history. Diagnostic methods in particular are being constantly improved together with techniques for studying the complex processes of mental and physical health. Here, a little boy plays happily in the laboratory of the Moscow Institute of Pediatrics while the activity of his brain is recorded on an electroencephalogram.
APRIL 7 this year marks the twentieth anniversary of the World Health Organization.

Looking back, WHO and its Member States have witnessed the general improvement in world health which is largely due to their combined efforts. There have been disappointments; there still remain the inequalities between the developed and the developing countries which is the Organization’s aim to reduce.

In general, however, the record is one of success and achievement. Recent scientific advances have already contributed to these achievements; they will do even more in the future. Therefore on April 7 and throughout the Anniversary Year it is proposed to concentrate on the theme: “Health in the World of Tomorrow”.

TOMORROW clearly means the next ten or twenty years. This is the period during which the scientific discoveries of the past decade will become generally applicable, and the new ones now germinating will prove their worth. These advances will affect the health of people in every country. How will they operate?

We can assume that there will be some general improvements in environmental conditions, the control of communicable disease, nutrition, and in a greater availability of medical care. These will certainly be beneficial. But the impact of the new discoveries will be most dramatic.

We have been told that it is not unreasonable to expect from the extensive research now being undertaken a break-through in cancer. Similarly, more precise knowledge about certain common diseases of the heart and blood-vessels and their relation to the chemistry of the body opens up the prospect of controlling these great killers of today.

Research into the chemistry of our tissues and organs may throw light on the process of ageing and bring us nearer to the postponement of old age.

More will be learnt about the causes of the mental disorders, and when we are able to classify them better, treatment will be more specific and effective.

Drugs and antibiotics to cope with hitherto elusive viruses are other possible additions to this incomplete but formidable list.

BUT mankind will still be exposed to a multitude of influences which unless controlled can nullify these expected advances. Some are old, some new, but all are potentially if not actually harmful. The list includes the various chemicals with which we live—pesticides, food additives, radioactive residues; the polluted air, soil and water; urbanization with its possible squalor, disease and social maladjustments. In many countries population growth will bring comparable problems. Add to these the insidious evil of drugs and we have a grim catalogue.

Weighing the effect of these influences and remembering the health promoting activities now in progress, I consider the balance is favourable. The individual should benefit. He will have better health with which to enjoy the leisure and the longer life which the future promises.

Finally what is the role of WHO in all this? It is not new. Much of the Organization’s current programme has foreseen these developments. Indeed, many of its research activities have already contributed to them. WHO will maintain and extend all these interests, stimulating the advancement of knowledge and encouraging its application for the benefit of all.
LONGER LIFE — LESS SICKNESS

by Jean-Michel van Gindertael

To what extent can man hope for a longer life-span in the world of to-morrow? We are not talking about the normal expectation of life at birth. This has certainly increased—almost doubled, in fact—in the space of a century and a half.

Expectation of life is more a question of mathematical probability—a science which the actuaries are constantly seeking to perfect—and according to which a man in the developed countries now rates an average life expectancy of 75 years, and a woman a span of 80.

If we are to increase that estimation within the coming decades, it will be necessary to reduce all mortality factors. This would include infant mortality, the accidents that happen to children, the cardiovascular diseases that affect the mature adult, and so on, and not simply the factors that affect old persons who have gone beyond the normal span of life as we see it today in 1968.

How far will the works in the human clock go on ticking? The likeliest estimate is about 100 years. Already there are cases here and there of people living to 120, 130, even 150 years.

But is modern man then biologically different from his ancestors? Yes and no. For while it many be true that life for early man was short (20 to 40 years, and very exceptionally 50), the Bible fixes the normal human life-span at three score years and ten. And we have precise information concerning the lives of the ancients: Virgil died at 51, but Pythagoras lived to the age of 82. Plato lived until 80. Plutarch to 74, Xenophon to 73, Epicurus died at 71, Cicero at 64 and Ovid at 60.

These figures do not differ a great deal from those which are applicable

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THE CHALLENGE OF CANCER

Cancer is the second killer disease after cardiovascular diseases in industrially developed countries. Cancer is a cell disease which can affect any organ or tissue of the body. When a cancer cell appears it divides in two and then sets off a chain reaction of rapidly multiplying cancer cells. Division, seen in photomicrograph, right, takes 90 minutes. Photo left shows treatment of cancer patient by cobalt bomb. Drawings, far right, show experiments by an American doctor of Buffalo, New York, using a special graft technique: (1) Grafts are used to exchange tumours between patients with identical forms of cancer. (2) Patients develop antibodies against foreign tumour and graft is rejected. (3) Patients receive reciprocal transfusions of white blood cells. (4) White cells are tolerated by both organisms and tumours and secondary growths are reduced and in some cases eliminated.

FACING THE 21ST CENTURY (Continued)

Promise and dangers of genetics

today, in developed countries, to the majority of men. And yet the way of life of the ancients, their nutrition, habitat, activities and preoccupations were in many respects different from ours. And while it may be true that we are still following some principles of medicine that have come down to us from Hippocrates, the ancients had nothing to compare with modern medical knowledge and the therapeutic advantages we derive from it.

However, this consistency in man’s biological patterns across two thousand years of history should not surprise us: it must be admitted rather that a hundred generations is precious few in the perspective of man’s ancestry. We all know examples of longevity running in families, and the study, for example, of monozygotic twins (commonly called “identical” twins) shows that their respective life-spans are often of similar length, even though they may live in divergent environments.

We also know, and it is perhaps here that man’s future may for the first time be radically affected, that ionizing radiations (those used in industry and medicine much more than nuclear fallout) as well as certain chemical substances are capable of bringing about mutations, for the most part harmful, in the genes, or hereditary characteristics. If a gene is altered, the normal functioning of the human body can be affected to an extent far beyond what is acceptable.

One of the tasks of modern research is to discover the exact functions of the genes of the individual. Already we have learned how to avoid the effects of certain serious illnesses of genetic origin such as phenylketonuria which causes serious mental retardation, albinism, and diabetes, and other afflictions of an hereditary nature. Eventually we will learn how to repress the ill-effects of certain genes by a biochemical process.

However, although man is now able to correct at least partially some of the built-in errors of metabolism (phenylketonuria is a case in point, because its effects can be neutralized if the disease is detected after birth), we have to face the fact that the problem has been moved to another area rather than eliminated. Up to now, children who had these afflictions either died very early or else were incapable of reproduction. Now that science has intervened, they can procreate, transferring their handicap to an increasing number of human beings through the years to come.
In the opinion of the geneticist, Hermann J. Muller, a Nobel Prize winner (1946), we should seek to go further, producing super-beings by artificial insemination, using freeze-dried spermatozoa from men of acknowledged intellectual stature.

This view, and similar arguments linked with the concepts of the post-Darwinian school, lead us to revolutionary theories of “manipulation” of the human species, so that man’s physical attributes will match the complex society of the future. In the same way, if we follow the thinking of the American biologist, J. Lederberg, also a Nobel Prize winner (1958), we will find ourselves on the threshold of an era when artificial human organs such as the heart or the kidney will be mass-produced, and hormones, enzymes, antibodies, etc., will be synthesized at will.

As far as present possibilities are concerned, such proposals remain in the sphere of science fiction, apart from the fact that they present us with difficult philosophical, social and religious questions. What criteria would we select, for example, in creating our supermen? But we cannot shrug off the whole thing off, for science is on the brink of achievements that would make the fiction of today a fact tomorrow. The future dilemmas posed by such doctrines as eugenics (Muller) and euphemism (Lederberg), and euthanasia as well, are likely to rack men’s minds even more than the problems of the past 25 years, i.e. since the discovery of nuclear weapons.

Apart from genetics, we must seek also to achieve fuller comprehension of immunology if we are to improve the conditions of existence. I am referring now to that essential balance which, when disturbed by the appearance of a foreign body, brings about the production of an antibody specially designed to neutralize it and defend the organism.

There are of course cases where the response is insufficient or too slow, and others where the antibodies commit “errors of identification”, and illnesses result. Immunology is, therefore, in spite of popular belief, much more than the science of vaccination (which is in essence but the first and most elementary application of the principles involved).

Let us take an example from the battle against cancer. If we accept the theory that the cancerous cells which multiply in the body contain a substance foreign to the normal tissues of the organism, the immunological system should intervene to annihilate the invaders.

Experiments have been made with the transplantation of cancerous tissue in men and animals. With animals, it was established that vaccination with extract from cancerous tissues pre-
vented diseased tissue from spreading when transplanted.

On the other hand, an experiment was conducted in which 50 cancer patients received an injection of an extract from their own cancerous tissue, and an injection from their own normal tissue for comparison. There was a positive reaction in 27 per cent. of cases in regard to the cancerous tissue; but a negative reaction to the extract of normal origin.

In fact it is quite possible that something like 10,000 cancerous cells invade our bodies every day and are halted and neutralized by our antibodies. According to a theory advanced by Sir Macfarlane Burnet, it is only when the reaction by the antibodies is insufficient, too weak, or too slow, as a consequence of the aging of the organism, that cancer gets the upper hand. This would so explain why cancer affects mainly the elderly.

Immunology is, of course, but one approach to the cancer problem. (It is also possible that the disease is caused by a virus or some other factor which alters the information code of the cell to such an extent that the cell is no longer controlled by the central system.)

A quotation from Dr. Alex Comfort, one of the best-known experts on the problem of senescence, sums up the argument:

"The most important single change in our world, where life-span is concerned, is that in privileged countries our children grow up and reach old age and our wives no longer die in childbirth. Men have always known the probable limit of their lives. We now know more accurately than ever before when we are likely to die. The most important future change depends on the progress of our understanding of fundamental age processes. If the present trend of medicine continues without such progress, all that will happen is that the commonest age of dying will shift from being nearer 75 to being nearer 85, and the commonest causes may change so that we die of conditions which are not now so common, today's most frequent killers having been removed to uncover the next layer of the onion."

But he points out that there are other aspects of the issue. If it is possible to make fundamental changes in the human organism, it should also be possible either to increase the period of adult vigour alone, or the period of adulthood and the period of onset of old age, without extending the average length of life.

Another and more valuable possibility would be to prolong unduly the infancy cycle, but to be able to insert between the years of 20 and 30 a "bonus" of, say, five years, after which the person concerned would revert to his normal life cycle.

If such progress—and it is much more radical than the question of simply adding a few years to the average human-life-span—is ever achieved, medical science will have succeeded not only in altering the processes of life for man's benefit, but in changing all his ideas about death. The grim Reaper will come, without the usual forewarnings, at an age which remains undetermined, and that may well lie beyond the "limits" which we know today.

**Bigger populations — less food**

The world's population has been increasing steadily for centuries, but the growth is accelerating. According to the experts, the world's entire population was only about two or three hundred million at the beginning of the Christian era. It took 16 centuries, i.e. until the Renaissance, to double in size. But by 1850 the total had reached 1,000 million, and 2,000 million by about 1930. The pace continues to quicken, creating an impenetrable congestion by many as foolish and unconsidered, for they argue that the earth cannot feed an infinite number of mouths. Even now, in the year 1968, only a few privileged countries enjoy an abundant or indeed overabundant food supply.

It may however be wrong to see the problem in a pessimistic light, for it has not been demonstrated that our planet will be unable to nourish a much larger population. The British economist Colin Clark has asserted that, by making the most of science and technology, it would be possible to produce enough amino-acids to sustain 45,000 million people.

This figure is challenged by other authorities, however, for a world population of such dimensions would throw unbearable strains of a different nature on our resources. Not only would it be necessary to cultivate every inch of available land—further space would have to be found, in itself agriculturally unproductive, for new towns, new roads, all the other bits and pieces needed on account of man not living "by bread alone".

It must not be forgotten, however, that there are many countries today which cannot develop their agriculture efficiently because of low population density. It is not always the most densely-populated countries which have nutrition difficulties. Malnutrition occurs in New Guinea, for example, where there is only one person per square kilometre, as well as in sparsely-populated areas of South America and Africa. On the other hand, densely-populated countries like Belgium and Holland have ample food supplies.

The equation linking overpopulation and hunger can only be understood if a number of other essential factors are taken into account. These factors include the level of economic development, education, climate, and the quality of the soil. There are also some highly industrialized countries which rely largely on food produced elsewhere. But a developing country which has to make huge purchases of wheat or other foods abroad in order to meet the needs of her people, inevitably weakens her foreign exchange position thereby putting a brake on her own industrial and agricultural development and puts off the day when she will be independent of foreign economic aid. The food situation in many countries is also worsened by religious taboos, by lack of nutrition education and by vast though preventable wastage (by rats, for example).

Education has a very important part to play. Too often we find malnutrition, even hunger, in regions where in theory food should not be scarce. When, for some local reason, there is a ban on eating eggs or fish or certain kinds of meat, people often substitute things which are low in vitamins, iron and amino-acids, and therefore are not sufficiently nutritious.

Very often these dietary deficiencies aggravate the condition of persons already weakened by parasitic diseases, such as bilharziasis and ankylostomiasis. In Africa, for example,
Scientists have constructed a three-dimensional model to show the complex structure of the cells in the human body. Photo shows close-up view of centre of model, which is 24 feet in diameter and 12 feet in height, and more than one million times the size of a living cell. The human body contains 100 million million cells in which protein molecules constitute the enzymes that operate complex chemical changes in the cell. Each cell contains thousands of different kinds of protein molecules, and nearly every one of these protein molecules contains several thousand atoms.
deficiency diseases, such as kwashior- kor, are widespread. Their early stages have been diagnosed in 30 per cent. of children in the weeks following weaning, and they cause thousands of deaths every year.

Fortunately, modern science is potentially capable of meeting the challenge of a population of 6,000 million or 7,000 million by the year 2000. But to do so, total world food production would have to be increased by 170 per cent., and products of animal origin by 200 per cent. The production increase required in the developing countries, where nutritional deficiencies are most frequent, would have to be of the order of 500 per cent. (i.e. six times the present output).

There would also have to be a radical adjustment of world trade sweeping away the present division between "rich" and "poor" countries. We could take another step in the right direction if consumers could be persuaded to change their food habits to some degree. Governments could make an important contribution by subsidizing certain food products which are rich in protein. Groundnuts, oilseed and even some industrial residues now used in their raw state as cattle fodder could be specially treated for human consumption.

A cautious optimism seems justified. Certain amino-acids can already be manufactured synthetically, though in small quantities, but we are still a long way from the point where they could usefully be incorporated in actual diet. Studies have also been made of the possibilities of using plankton, seaweed, yeasts, even bacteria operating on chemical products with a petroleum base.

Sea farming also offers interesting possibilities. During a recent conference on development, it was suggested that large-scale breeding grounds be established where fry would be safe from their natural enemies, and fed until big enough to fend for themselves. They would then be released in the fishing grounds. Since the fishing fleets of all nations have equal rights in these grounds outside territorial waters, systematic restocking would have to be carried out within the framework of international agreement.

Some experts at the conference even suggested that the sea-bed which, to all intents and purposes, is a vast compost heap, might be exploited. Remote-control harrowing equipment might be used, or even compressed air, which would turn over the sediment and bring rich, nutritive materials closer to the surface.

But it is not enough simply to find more food. Man also needs shelter, education, welfare and a social life. He needs not only the means, but also a reason to live. All this may still be within the bounds of achievement in the world of 7,000 million people, as predicted for the year 2000. But all our hopes would be submerged if the present geometric rate of progression were to continue: some 40 years later there would be a population of 12,000 million. Children now being born may well live to see the year 2040.

The mind has difficulty in grasping such possibilities, and many may dismiss the figures as mere abstractions. It does appear that the rate of increase in the industrialized countries started flattening out as soon as a certain level of economic development and social well-being was reached. But by a quirk of fate it is in those countries where existence is most precarious that the population is expanding most rapidly.
FIRST DOCTOR IN SPACE

On October 12, 1964, a young Soviet doctor, Boris Egorov, orbited in space for 24 hours as a crew member of the Voskhod I, a 6-ton Soviet spaceship. His task was to study the effects of space flight on the organisms of cosmonauts, including the nervous and cardiovascular systems. In flight he recorded the biological currents of his own brain and those of his companions, Konstantin Feoktistov and Vladimir Komarov. Dr. Egorov's medico-biological space research, notably his studies on the vestibular apparatus of the ear, including the effects of weightlessness on the sense of balance, was the subject of the thesis he later submitted for his Master of Science degree. 

A number of explanations have been advanced by sociologists. The most persuasive is based on the steady improvement of man's health over the past hundred years. This is perhaps to be ascribed not so much to medical progress as to general advances in hygiene, ranging from the purity of water to working conditions in factories, without forgetting the important role of compulsory schooling for all children.

In the absence of statistics, we have no means of knowing the full ravages of mother and child mortality before the beginning of the 20th Century. What we do know, however, is that even in recent times in Europe, it was taken for granted that of a family of six or seven brothers and sisters, three or four would die in childhood.

On the other hand, in an economy where child labour was quite legal and often actively exploited without the slightest scruple—see the pages of Dickens—the large family offered a primitive kind of social security at a time when official systems were nonexistent. Farms were unmechanized, and needed armies of workers, while in the cities the apprenticeship system was a substitute for schooling, and relieved the father of a family of his material responsibilities as early as possible.

While this social pattern has almost vanished in the developed countries, such is far from being the case in the economically less advanced countries which are desperately trying to catch up the hundred years' advance that industrialization and increasing social justice have bestowed on North America, Europe, the U.S.S.R., Japan, Australia and New Zealand. But until industrialization arrives, the developing countries adhere to the traditional family pattern, even though we are now in an era where a child born anywhere in the world has a better chance than ever before of achieving his normal life-span.

That infantile mortality is decreasing is obviously to be welcomed, and we must see to it that over the next decades a common standard of health is achieved for all mankind, something which is far from being the case at present. The fact remains that health work is ahead of economic development, and if this gap persists, it will be detrimental to both.

It took India hundreds of years, from the dawn of her history until the present day, to bring her population to 500 million. But if the population continues to increase at its present rate, another 500 million will have been added between now and the end of the century, i.e. in about 30 years. It is hard to imagine the gigantic investments needed to create a viable economy that would yield adequate reinvestments in the form of housing, hospitals and roads for a population that has doubled in size. Yet even if all the aid now available from the highly developed nations were devoted to India alone, it would still not be enough to meet present needs.

Should there be fewer children? Some countries say yes as far as they are concerned. In other countries where the population pyramid is already out of shape and where the progress of medicine by increasing the average life-span threatens to make it top heavy there should be more children. Birth control is advocated in some countries, condemned in others, and in yet others is a matter of indifference. Clearly, in 1968 at least, there can be no world-wide solution.

We must hope that advances in scientific knowledge will ease the pressures which soaring birth-rates are already now creating in some of the developing countries. The year 2000 is likely to be difficult, the more so since the population explosion is linked with an inexorable process of urbanization which, in spite of its many unpleasant aspects, will probably affect at least two-thirds of mankind.

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WHEN the twenty-first century dawns the world’s population will have grown to six or seven thousand million people, according to present demographic forecasts. The majority will be living in vast conurbations, compact yet tentacled as the octopus, the living seas of anonymity, which will either have exploded from their present confines or arisen virtually complete in areas which today are still deep in the countryside.

The fact that in 1968 such a prospect causes us to shudder a little, or that at any rate we view it without pleasure, is an indication that the transformation will not take place smoothly. The ordinary individual fears that he will be starved of light, air and space, and most of all that he will lose his individuality in what will become a vast ant-heap. In effect, he fears that his health, his physical and psychological well-being, is going to be at risk. Is he wrong?

Yes and no. He is wrong, in the sense that the urban experience has not in fact up to now endangered his health, and has had rather the contrary effect. It was because his daily life was hard that the individual left his fields, came down from the mountain, emerged from the jungle to settle in the town, and earn there the bread that he could not find elsewhere. The town gave him the liberty of the labour market, opportunities for culture and recreation, and some guarantee of health care. Statistics confirm that, in regard to general health at any rate, the promise offered by city streets has been fulfilled.

And yet ... Even while granting that the town or city as we know it today takes man’s needs into account, can we say as much for the city of tomorrow? In the developing countries, the expansion of population around the urban zones has created hideous shanty-towns that lack the most elementary sanitary equipment. And in the big cities of the industrial nations, pollution of every kind is rife. It manifests itself in the approach of city streets and in the vicinity of airports, in the discharges into the atmosphere from the exhaust pipes of our cars, in the hurled, jagged patterns of daily life which create around us a kind of psychological pollution.

There are, therefore, an army of challenging problems facing the man of tomorrow. But we should say, rather, the man of today, for the possible solutions require time as much as money, imagination as much as goodwill. Social problems are linked with economic plans, health is affected by conditions of work and housing, in short, the approach must be integral, excluding nothing, forgetting nothing.

For the citizen of a developed country, nothing is more commonplace than water. He uses it freely since, as a general rule, it costs him almost nothing. And yet it is not an inexhaustible resource. In some western cities such as New York, he is reminded of this by occasional periods of water rationing during drought.

But when we turn to the developing countries, water ceases to be a preoccupation and becomes a problem of calculating the cost of providing a regular water supply where it is needed. Very often, there is no water supply at all. In those hovels one sees in the shanty-towns and bidonvilles, dwellings made from a few bits of wood and corrugated iron, even of mud, in the middle of scrap-heaps and dumps. Water has to be searched for, often very far away. As often as not it is of doubtful quality. Hence the enormous number of cases of cholera, typhoid, bilharziasis and filariasis. The two last-named diseases are seldom immediately fatal but have such debilitating effects that they reduce the economic potential of the sufferer and, as a direct consequence, the chances of material betterment for both him and his family.

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But when we turn to the developing countries, water ceases to be a preoccupation and becomes a problem of calculating the cost of providing a regular water supply which constitutes the real point of departure. An example of the importance of this is the city of Teheran, in Iran, which in 1932 before a hygienic water supply was installed had a mortality rate of 25 per 1,000. Thirty years later, and in spite of the fact that the population had greatly increased, the death-rate had fallen to 11.5 per 1,000.

The two last-named diseases are seldom immediately fatal but have such debilitating effects that they reduce the economic potential of the sufferer and, as a direct consequence, the chances of material betterment for both him and his family.

It is clear that the urban development of the next 30 years must not be a development of shanty-towns. The authorities must first solve the fundamental question of water supply which constitutes the real point of departure. An example of the importance of this is the city of Teheran, in Iran, which in 1932 before a hygienic water supply was installed had a mortality rate of 25 per 1,000. Thirty years later, and in spite of the fact that the population had greatly increased, the death-rate had fallen to 11.5 per 1,000.

WHO experts have attempted to calculate the cost of providing a regular water supply where it is needed. Very often, there is no water supply at all. In those hovels one sees in the shanty-towns and bidonvilles, dwellings made from a few bits of wood and corrugated iron, even of mud, in the middle of scrap-heaps and dumps. Water has to be searched for, often very far away. As often as not it is of doubtful quality. Hence the enormous number of cases of cholera, typhoid, bilharziasis and filariasis. The two last-named diseases are seldom immediately fatal but have such debilitating effects that they reduce the economic potential of the sufferer and, as a direct consequence, the chances of material betterment for both him and his family.
At the end of the 17th century the invention of the microscope first enabled scientists to perceive the complex nature of blood. A new science, hematology, was born. A modern laboratory count made on a single drop of blood (one cubic millimeter) normally reveals 5 million red corpuscles, 8 million white corpuscles and 200,000 platelets (particles which help blood to clot). Studies of the blood show what is happening in the human organism, since the proportions of its constituents vary according to a person’s state of health. Drawing shows the ten chemical components in a drop of blood: (1) Sugar. (2) Cholesterol. (3) Urea. (4) Fibrinogen. (5) Bilirubin. (6) Proteins. (7) Potassium. (8) Calcium. (9) Lipides. (10) Sodium.

WANTED: 3.5 MILLION DOCTORS

by Stanislav Kavka

If there is to be one doctor for every 770 people, then the world today is 3.5 million doctors short. The figure is staggering, but what of tomorrow when the number of people in the world may have doubled?

In medical education one always has to think of tomorrow’s needs, if only because it takes eight or nine years to make a doctor—about six years of medical school and two or three years of practical experience.

Population increases and changes in the composition and distribution of population are going to have great influence on health services, and the demand for professional health care can everywhere be expected to increase by leaps and bounds.

The economic aspect is important—new schools and teaching hospitals will have to be built and equipped—but so is the question of human resources, the question of attracting the right calibre of men and women as teachers and students. Over and above these considerations, the explosion of information and of scientific knowledge entails qualitative changes in the style of thinking and working: education will of necessity change both in form and in content.

Modern society and the modern style of life tomorrow call for doctors who have thorough professional knowledge, but also high moral qualities and a serious attitude to their work.

Education in medical schools and post-graduate institutes will have to allow for the fact that the doctor in his daily work will need to apply more psychology and sociology. At present, this is no doubt accepted, but the general assumption seems to be that the doctor will pick up the knowledge he needs in these two fields as he goes along rather than as the result of systematic teaching.

The danger of specialization is that the patient tends to become an object of investigation, of therapeutic techniques, and that the psychosocial factors are completely lost sight of.

This should not be. Specialization is without doubt a higher professional echelon than general practice, it is the terrain on which new discoveries grow, but too much specialization, eclipsing the general practitioner, can be detrimental to community health care, and if the family or district type of doctor is an essential member of the health team, then education in medical school should be geared to producing him.

Though specialization may be attractive to the young men and women entering the medical profession, they should not forget that the generalist has important and fascinating tasks to perform in improving general health conditions, in actively promoting health, in disease prevention and the early detection of cases, and in the psychosocial field.

POST-GRADUATE education is essential today if proper professional standards are to be maintained. The U.S.S.R. has 13 institutes of post-graduate education and 13 post-graduate faculties in medical schools. In the U.S.A., the American Medical Association organized 1,600 post-graduate courses in 413 institutes during one year (1966-1967). A new centre for post-graduate medical studies was opened in London in 1967.

In Czechoslovakia, all medical establishments take part in post-graduate education and a post-graduate medical institute was opened in Prague in 1953. Such activities will need to be intensified in the future to help doctors keep abreast of the new knowledge and new techniques that are going to transform medicine in the future.

In conclusion it is probably justified to give an optimistic prognosis on the world’s endeavour to secure the health of the human race, provided effective international co-operation is supported by all countries.

The isolation of some countries needs to be abolished by an intensive international exchange of information and the development of science. Medical education on a level with contemporary scientific knowledge is an essential factor in the achievement of better health for man tomorrow.

DR. STANISLAV KAVKA is an official of the Public Health Service in Prague, Czechoslovakia.
The click of computerized medicine

by John Anderson

The human brain comprises 10,000 million cells— as many as there are stars in our galaxy. Impulses from the nervous system keep these cells in a state of constant chemical and electrical activity. Sometimes the electrical discharges in the brain become excessive and aberrant, as in the case of an attack of epilepsy, a nervous disorder about which we have still much to learn. Use of a new technique, stereo electro-encephalograph exploration (shown in photo), now enables doctors to locate precisely which parts of a patient's brain are linked with his attacks of epilepsy and to decide whether or not to operate. Electrodes placed in skull detect electrical discharges and data is recorded by investigating apparatus. Doctor observes patient's reactions on a TV screen. 

Mr ABA awakes one morning feeling but a sick shadow of his usual self. His wife and children also think he is ill. The television telephone is moved to his bedside and he talks to his doctor.

The doctor works in a modern health centre and talks directly with his patient, seeing him at the same time on his television telephone. He determines the patient’s symptoms, finds out that he has a headache and feels sick and feverish, and decides by looking at him and hearing what he has to say that he is fit enough to visit the health centre if he comes by special air-conditioned electrical car.

Immediately the doctor switches on the visual screen connecting him with the computer. He speaks the patient’s name and address in a special tone of voice, and asks the computer for Mr ABA's medical record. This is displayed for him on the television screen of his computer link. He reads it and then dictates further information to the computer link. The computer arranges the appointment for Mr ABA and records the doctor’s observations.

On arrival at the clinic at the appointed time, having had his transportation from home organized by the computer, Mr ABA goes straight in to see the doctor in Room 82, direct-
COMPUTERIZED MEDICINE (Continued)

ed by the nurse in the vestibule who has received her instructions from the computer voice coming from a terminal located there. She records Mr ABA's arrival by his name and number which she speaks into a special microphone.

Mr ABA is seen by Dr. X who talks further with him about his symptoms, examines him and suggests that further tests on blood and urine are required. While the specimens are being obtained, the doctor dictates a medical summary of Mr ABA's illness and his other observations to the computer terminal.

The computer television screen comes up with a possible list of diagnoses. The doctor indicates the likely possibilities and the computer agrees, but suggests another less familiar possibility and further tests the doctor might do. The doctor decides he would like some more information about this special aspect and after requesting access to the computer medical library is able to read on the screen the special information he has requested and the summary of the past experience of many clinics obtained by the computer system.

The doctor collects the required blood and urine specimens in special containers which are automatically removed by a computer-controlled tube communication system to the two automated laboratories where the various tests will be done. The computer estimates the time the tests will take and informs the doctor when the results will be ready. Mr ABA goes to the waiting room and is soon summoned to return by the computer as it now has his results ready. The doctor also is informed.

The doctor then prescribes the appropriate treatment, advises Mr ABA to stay at home for a few days, and to get in touch with him again if all is not well. Before Mr ABA's departure the doctor dictates to the computer terminal the treatment his patient requires. This is checked by the computer and the message passed to the automated pharmacy department in the Centre.

At the pharmacy the computer arranges the various sorting devices to locate and fill the boxes with the appropriate tablets for Mr ABA, print the instructions and label the boxes automatically. The pills are then transported by tube system to Room 82 and the doctor hands them to Mr ABA. The doctor checks the patient's instructions and tells the computer that the patient has his treatment and that no further arrangements are necessary unless Mr ABA calls.

The computer then enters all the data on Mr ABA; including the treatment prescribed, in the central file of the Centre. Much of it being available only restricted access than is at present allowed, much of it being available only.

While the specimens are being obtained, the doctor dictates a medical summary of Mr ABA's illness and his other observations to the computer terminal, the radiation emitted.

KIDNEYS SEEN VIA GEIGER COUNTER

To study the general condition of a patient's kidneys or to confirm the presence of a tumour, doctors sometimes use a diagnostic technique called scintigraphy. After injecting a radioactive substance which concentrates in the kidneys, they use a Geiger counter to pick up the radiation emitted. The results are recorded as dots which form a picture or scintigram. Right, scintigram of normal kidneys.

On arrival to see the hospital consultant, Mr ABA would be directed from the reception desk to the doctor's office by a nurse. There would be no waiting, all arrangements having been made by the computer. Again, after talking with Mr ABA and examining him, the hospital doctor would record all his medical data on the computer, which would take care of the investigation schedule and the treatment.

If Mr ABA needed to go into hospital, the computer would arrange for his bed and meals and for nursing staff to be allocated to him. All the hospital's communication would be done by means of the computer, so that records would be made as information was received. Both hospital and health centre would use the same medical data bank for Mr ABA's medical record, much of it being available only to his doctors with a much more restricted access than is at present allowed, thus giving Mr ABA complete confidence in the safety and reliability of the system.

Patients in the year 2000 have found that the computer cuts out the time spent waiting to see the doctor and organizes automatically the medical procedures. As it does not tire or get bad tempered and only rarely breaks down, patients have come to take it all for granted.

The doctor too has had to learn about medical computing techniques and during his training has become used to working with a computer. In some parts of his course, where he has had to memorize a great deal of information, he was taught by the computer which corrected his mistakes patiently and with good humour no matter what the time or the occasion. The computer was used to teach him the tone and emphasis to use in giving it instructions. Speech and information flashed on a screen now provide a much quicker and rapid means of communication between man and computer.
The computer has greatly increased the facilities available also to the family doctor who can order many investigations and use the computer to interpret the results, or get it to search the literature relating to a specific disease and give him a summary of world medical knowledge on the subject.

With such a system, the approach to illness and health has altered. The man-machine relationship has now emphasized the importance of pre-symptomatic disease which is present before the patient feels there is anything wrong. This has been one of the major developments in medicine in the year 2000 when most of the infectious diseases as well as cancer have come under the control of new and powerful drugs.

The key to the problem lies in the body’s reaction to disease, where it can compensate for many errors until the control starts breaking down and symptoms arise. A deeper understanding of cybernetic mechanisms as a result of new man-machine techniques has brought this to the fore.

It has been found that drug influences may be more potent and accurate if given earlier. New techniques exploiting the advances in knowledge in physics, chemistry and bio-engineering have all been used with great effect for the patient’s benefit.

What of computers themselves and the operating staff? The expenditure in effort to instruct the computers has been great and so was the initial expense, but once the task had been done it was well worth it because of its universal application.

The computers are still having trouble in translating all the languages but can already accept six or seven. Many doctors all over the world speak a universal medical language thanks to computer programming.

The computers are much smaller now, work faster and are organized into hierarchies of machines, looking after themselves to a great extent. Advances in electronics and engineering have made them much more reliable.

Many other automatic devices have been developed which the computer can control and which get rid of many of the automatic chores connected with a health service. On the economic side the performance of the computer and of the many automatic measuring devices and automated dispensaries has freed the health service from its dependence on various forms of human labour. Administration has been largely taken over by the computer; directors of hospitals and health centres are merely required to issue judgments on the data provided by the computer.

D I S T R I C T health services are organized and controlled by a series of computers. Health officials can track down physical and emotional problems to specific areas. Much has been done to improve emotional as well as physical health by alteration of the environment and support of the patient by skilled medical workers at the level of the home and health centre rather than at the hospital.

As the areas and health centres have undertaken more personal care of the patient hospitals have decreased in importance and are viewed as centres of investigation and research. Now many more doctors and nurses are outside hospitals, and the preventive measures due to the detection of pre-symptomatic disease have greatly decreased the incidence of gross disorders.

Man has much more leisure now to devote to family group activities and as a result human relationships have become richer. Control of the environment through man-machine techniques has kept pace with the progress in medicine. Everywhere the computer is an essential work-horse, much like the diesel engine and power cable in the middle of the 20th century. The man-machine revolution is still continuing in the 21st century and is creating many problems at national level because of the speed of advance.

Problems have arisen because of the explosion of information in every direction in society and in particular in the medical field. Economic management of hospitals and area health services has proved difficult. On a national scale the same problem exists, for ideas about making computers reduce the flow of information by developing techniques to sift and sort various types of data are hard to prove. Thus the unorganized randomness of information is still with us.

While Mr ABA’s care by able management is good at the local level, serious difficulties in the direction of the service at higher levels reduce the efficiency of medical care. Overall management services have resisted the challenge of the man-machine age longer than any other. There have been delays in the implementation of new ideas and progress has been slow and difficult.

The doctors have already accepted that the man-machine era has arrived and have been working hard to force administrative advances based on computer techniques. Already they have found that they have to be the leaders in creating a new administrative system—a revolution comparable with that in public health many years ago. The era of the non-professional approach to management at higher levels has been relegated to the past and it is accepted that this task needs special and exceptional talent.

On the international scene things have proved to be just as difficult. Man-man relations have proved to be
LASER-SCALPEL

The laser beam has given surgeons a new tool for cases where diseased cells have to be destroyed with extreme precision. Directed as a sharp, hot point, the beam works as an ultra-fine "scalpel". Right, surgeon focuses a laser on patient suffering from skin cancer of the neck.

'RADIOACTIVE MAP'

OF THE BRAIN

"Radioactive maps" of the brain help neurologists to detect brain tumours. Site of tumour (arrowed) on "map", top left, was revealed 24 hours after injection of radioactive substance. Other dark areas are normal patterns. Bottom left, patient's head placed in a tetrascanner at the research hospital of the National Health Institutes, at Bethesda, near Washington, U.S.A. The instrument "explores" the brain in four directions simultaneously and detects and locates tumours with the help of radioactive isotopes. Data is shown as marks on films and paper, and if a tumour is found all the marks will add up to four silhouettes of it.
One baby in ten dies prematurely. In some cases of premature birth survival depends entirely on minute by minute care and surveillance. For this task, modern medicine has devised electronic, automated "mother" machines. Left, the automatic incubator monitoring system at the Centre for Biological Research of the Newborn, at the Port Royal Hospital, Paris. An electronic computer simultaneously records the respiration, temperature (taken every 24 seconds) and heartbeats of six babies lying in their incubators. At the first sign of anything abnormal the machine sounds an alarm.
The basic principles of medical ethics have not changed since the time of Hippocrates 2,500 years ago and therefore are not always easy to apply to new situations created by biomedical advances. In what circumstances should experiments be made on a sick person? Or on a healthy one? What weight has the consent given by a volunteer for experimentation? What criteria, for example, should be used to choose a donor for organ transplantation? Medical men are justifiably concerned over these problems which have aroused keen public interest. In the practice of medicine, unprofessional conduct is punished by prosecution for malpractice, but experiments on man are still not controlled by law in most countries. Medical science thus faces a dilemma. The different aspects of these problems were examined at a Round-Table organized by the Council for International Organizations of Medical Sciences (CIOMS) in Unesco's headquarters, Paris, on October 7, 1967. CIOMS was set up in 1949 by Unesco and the World Health Organization. We publish below the opening address by Professor Marcel Florkin, of the University of Liège (Belgium), president of CIOMS and (on pages 25-27) passages from the Round-Table discussions between eminent scientists in medicine and medical research. These reveal the diversity of views and the complexity of problems posed today by medical ethics.

Round-table on the doctors' dilemma

MEDICAL EXPERIMENTS ON MAN

by Marcel Florkin
Scientific progress rests at one and the same time on observation of patients and on the results of experimental science. The foundations of the development of clinical science are to be found in animal experiments, and no one denies that one of the most essential conditions of medical progress is freedom to carry out such experiments in accordance with well established principles. Nevertheless, it is also equally obvious that the prime condition of advances in diagnosis, prognosis, and treatment is the application of clinical science to man.

Indispensable though they indeed are, trials on human beings clearly have limitations. Is it not sufficient to leave it to the conscience of the doctor himself? Such an attitude has been shown to be tragically insufficient, as was demonstrated by the criminal actions of Nazi doctors.

During the Nuremberg trial, Brigadier-General Telford Taylor, after stressing the necessity of trials on human beings, since the results could not be obtained by any other means, formulated on August 19, 1947 a series of principles which he claimed to be universally acceptable.

The first of these principles requires that the subject of an experiment should be fully informed and give his voluntary consent to the experiment. But already there are difficulties here, for the principle is inapplicable to children and to mental patients. However, the voluntary consent of the fully informed family of the subject can take the place of the subject’s own consent. The definition of consent raises other problems, such as its mode of delivery, whether oral or written.

One serious drawback of the first principle of Nuremberg is that to inform the subject may be to thwart the purpose of the investigation, as when drugs and placebos are administered successively. However, it seems that full information need not necessarily be given in respect of obviously harmless aspects of the trial.

The second Nuremberg principle requires the investigation to be such as to provide results that are for the good of mankind and cannot be obtained by any other method. There has been speculation on several occasions as to whether the demonstration that a new therapeutic method is ineffective could be considered as a result redounding to the good of mankind. It seemingly could be regarded as such in the broad sense, since it prevents the application of ineffective methods.

The third Nuremberg principle lays...
The ethics of clinical research

The Declaration of Helsinki also states that in the treatment of a sick person the doctor must be free to use a new therapeutic measure if in his judgment it offers hope of saving life. If at all possible, consistent with patient psychology, he should obtain the patient's freely given consent after the patient has been given a full explanation. In case of legal incapacity, consent should also be procured from the legal guardian.

With regard to non-therapeutic clinical research, the Declaration of Helsinki is very close to the Nuremberg rules. It nevertheless specifies that consent should as a rule be obtained in writing after the subject has been fully informed. The responsibility for the experiment, however, always remains with the research worker.

The investigator must respect the right of each individual to safeguard his personal integrity, especially if the subject is in a dependent relationship to the investigator, as a student to his teacher, a prisoner to society, or a conscientious objector to justice. The two sections of the Declaration of Helsinki can be considered separately.

The application of new therapeutic measures is undoubtedly essential for the progress of medicine, as no one will deny, but it is impossible to state categorically that such new therapeutic methods have always been applied with all the requisite precautions. Generally, the methods are based on judicious physiological reasoning and adequate anatomical knowledge.

N ONE the less, the analysis of the history of gastrojejunalostomy made by John A. Ryle, in his book, "Changing Disciplines", proves with ample detail that new methods are not always sufficiently subjected to criticism or correctly tested statistically in practice. As Ryle has stressed, treated cases should be followed up for several years, possibly as many as ten, and most of the subjects treated should be given a control examination by competent investigators. The controls should preferably be carried out by a small number of large, very well equipped medical centres and in accordance with standardized methods.

With regard to trials of very active new drugs, as in the case of antibiotics, there would obviously have

AUXILIARY HEART

This machine is an artificial heart. It is not designed to replace a human heart but to help persons with serious cardiovascular diseases such as myocardial infarction, by relieving and resting the damaged heart until it can again take over its normal functions. The four elements of the machine, used in the U.S.A. recall the auricles and ventricles of a real heart. But the artificial heart, basically a pneumatic pump, does not beat. Its pumping system sends blood coursing continually through a patient's arteries and draws back blood from the veins while maintaining the correct blood pressure.
been no indication for delaying till the end of a long control period their employment in such serious illnesses as septicaemia, meningitis, or endocarditis. But a long control period seems necessary where the illnesses have a low mortality and spontaneous cure may be mistaken for therapeutic effect.

LASAGNA, in his book "The Doctor’s Dilemma," cites the case of a trial carried out on a group of soldiers suffering from streptococcal sore throat, in which half received sulfonamides and the other half antibiotics. It was certainly not possible at the time to foresee that the subjects given sulfonamides would not be protected against rheumatic fever, but it was foreseeable that the control group not receiving antibiotic treatment would show an incidence of about 3 per cent of that condition.

The control group should therefore have been given penicillin, which was already at that time known to reduce the incidence of rheumatic fever following streptococcal infection. A practice also to be condemned is to subject patients with a fatal prognosis to trials of a kind not likely to improve their condition.

In the United States of America, the National Institutes of Health continually carry out clinical research on human beings at their enormous Centre of Clinical Research. A Clinical Research Committee studies the projects of experimental research, which cannot proceed without their previous agreement.

A check of the same kind is made before clinical research is undertaken in the medical centres of the Atomic Energy Commission. Patients are invited to go to the centres free, but they are advised not to accept the invitation unless they agree to submit themselves to a period of research in accordance with guidelines laid down by the appropriate committees.

Non-therapeutic research is practised on a large scale in certain countries, the subjects seeking payment, or remission of punishment, for their participation or counterbalancing their position as conscientious objectors in relation to military actions, or the like. Although consent of the subject is particularly necessary in these cases, it is not sufficient to guarantee that the rights of the individual will be respected.

A few years ago, an inquiry was carried out in Harvard Medical School (U.S.A.), into persons appearing as volunteers for experiments. It showed that 60 per cent of them were maladjusted and had problems in adapting themselves to their social environment. Other inquiries have confirmed that volunteers for experiments may, from the psychological point of view, differ considerably from the rest of the population. This further complicates the concept of informed consent.

It could be held today that a doctor sending consenting human beings to the moon and back in accordance with a plan popularized among the public would not be different in his attitude from the Nazi doctors who were tried at Nuremberg (unless of course the trip was a success).

This can be said today, when the trial-and-error methods and the gambling on success that were so long in favour in space exploration have just very recently become unacceptable and a preliminary programme of animal experiment, especially on monkeys, is being developed in that field.

If anyone, worried about the protection of the individual in spite of a lively interest in astronautics, had said so a year ago, he would have been considered a defeatist and a desipier of both human courage and the skill of the engineer.

THE need to improve the cure rate in illness seems more and more necessary, and it can only be done with the help of trials on the human being. It is conceivable that, to ensure that the trials are conducted in the closest possible accordance with medical ethics, clinical research should be carried out in particularly well-equipped large clinical centres, especially university hospitals. A clinical research committee, acquainted beforehand with research projects, should approve them before they are instituted; and the responsibility should be not the experimenter’s but that of the clinical institution concerned or of the State.

Whatever the methods and rules might be, they can only be the fruit of the constructive thinking of doctors and the thousand-year old tradition of medical ethics, and the objective is to give medicine foundations that are both more scientific and more humane.

Pénicillium chrysogenum (penicillin). This antibacterial substance was discovered in 1929 by the British bacteriologist Sir Alexander Fleming. From mutations of the structure of the original penicillin, chemists have obtained over 500 related substances that vanquish many forms of infection.

A colony of the green mould called Pénicillium chrysogenum (penicillin). This antibacterial substance was discovered in 1929 by the British bacteriologist Sir Alexander Fleming. From mutations of the structure of the original penicillin, chemists have obtained over 500 related substances that vanquish many forms of infection.

This small device, called the pacemaker, is used to deliver regular electric impulses to a heart whose own natural pacemaker is faulty. Implanted in the thorax or under the patient's skin, it is connected to the heart by wires and powered by a battery that keeps it functioning for three years. Thanks to pacemakers, thousands of people are able to lead normal lives.

Swallow a radio transmitter and find out what is wrong with your stomach. This is what actually happens when someone gulps down this half-centimetre-long capsule containing a micro radio transmitter. The strength of its transmissions is regulated by the amount of acid in the gastric juices.
Medical experiments on man (Continued)

THE SCIENTISTS SPEAK UP

Bernard HALPERN
member of the Institut de France; professor (chair of experimental medicine) Collèg de France, Paris, France

THE term "human experimentation" raises a sinister echo in each of us. But fear solves no scientific problems. For my part, the recommendations of the WHO Group—that safety tests of new drugs should be carried out on fully informed volunteers in conditions of almost absolute security—is more in conformity with the requirements of ethics than the thousands of such trials hypocritically carried out daily in hospitals in all countries on individuals who are totally ignorant of what is being done to them.

Sir John ECCLES
Nobel Prizewinner for Medicine 1963; member, Institute for Biomedical Research, Education and Research Foundation of the American Medical Association, Chicago, U.S.A.

THE brain is the most wonderful organized structure in the universe... The other remarkable thing about the brain is that you can do very considerable damage to it, make massive lesions in it, and you do not get overt symptoms...

I would say, in relation to investigations which are of a dubious, or to my mind unallowable, kind, that a great proportion of these investigations could be satisfactorily done in primates; that there should be a great development of primate, and particularly anthropoid ape, investigation centres. I do not say that everything can be done on primates, but I would say that a great deal more should be done before we subject man to these traumatic procedures under any conditions.

When you say that you fully explain something to the subject, telling him what the lesion is or what he is going to be subjected to, and he gives his consent, I do not believe in the case of the brain that you can explain what you are going to do, because none of us knows sufficient about the brain to be able to say to a subject simply, precisely and with assurance that this is all that it will do.

André LWOFF
Nobel Prizewinner for Medicine 1965; director, Department of Microbiological Physiology, Institut Pasteur, Paris, France

We know today that very many pharmaceutical preparations produce in the long run a whole series of illnesses and disturbances. In this connexion, the conclusion of a WHO Scientific Group were the following: "The administration of biologically active substances to human beings must always be accompanied by some element of risk that cannot be avoided by the most careful and exhaustive scientific study of the drug before it is introduced. The introduction of new drugs... should be judged from an evaluation of the balance between benefit and risk."

Thomas Adeoye LAMBO
professor of psychiatry, University of Ibadan, Nigeria

IN most of the developing countries, and especially in Africa we find it extremely difficult to apply regulations and declarations based on experiences derived from developed countries.

The use of psychopharmacological drugs in developing countries is widespread and there is often abuse or indiscriminate use of the drugs, as also of antibiotics, narcotics, analgesics. Practically every village in Africa today has got some of these drugs, because of the indiscriminate advertisements in the newspapers, on the radio, and so on. And in fact some of the rural areas and the most remote villages in Africa are completely invaded by the people who sell these drugs. This again raises a great many questions, difficulties and dilemmas for those of us who are involved in medical practice and who are concerned with the philosophy and with the entire management of medicine.

We feel that there is an urgent need for young countries to learn from the developed countries and to avoid the mistakes which probably have been committed in most of these highly sophisticated countries. In practice, we have not been able to avoid some of them and there is a great room for flexibility and for original thinking.

The whole area of human rights is fundamental, but the contents, the priorities, and the nature of the so-called fundamental human rights may have to be altered to suit the needs of young developing nations because of their own evolution, and again this would raise quite a number of problems—problems which are religious, cultural, sociological, physiological, as well as questions which are entirely local.

Alfred GELLHORN
director, Institute of Cancer Research, College of Physicians and Surgeons, Columbia University, New York, U.S.A.

THERE is a need and necessity for experimentation on patients with neoplastic disease [cancer] because no experimental animal tumour model system is directly comparable to cancer in man. The therapeutic or physiologic studies should have a formal protocol which can be evaluated by others competent in oncology [the study of tumours].

The results should be systematically collected and also be subjected to objective scrutiny. The consent of the patient should be obtained, but the investigator and society should understand that this gives recognition of the status of the subject as a person and does not constitute a true informed agreement by the patient involved.

CONTINUED ON PAGE 26
"PHANTOM" OF THE X-RAYS

This plastic figure, nicknamed "the phantom", is used by specialists at the Cancer Institute in Villejuif (France) to perfect radiotherapy techniques for the treatment of cancer. Each of its numbered plastic sections offers the same resistance to radiation as the corresponding part of the human body. The exact intensity of X-rays that will reach the human organism is measured beforehand with a radiation meter at different points inside the figure. Doctors use the "phantom" to calculate precisely where to direct the beam on area needing treatment.
The patient with incurable cancer is not a hopeless case. No special liberties should be taken in the use of such subjects in clinical research. In my opinion such patients should not be utilized in studies of potential value to mankind without relevance to their own disease problem.

The cancer patient must be accorded the same status as a person as any other human. To do otherwise places cancer in the category of the leprosy of past centuries; it is an expression of the lack of information of the medical profession in the management of disseminated neoplastic disease.

Finally, the use of human subjects for research in which there is any real risk and from which results relevant to the subject cannot be expected is, I believe, a danger to the ethical fibre of the investigator, introducing an attitude of carelessness to the welfare of a fellow human being which ultimately could destroy his value as a physician.

Paul MILLIEZ
professor of clinical medicine, Faculty of Medicine, Paris, France

I have heard people talk for years past of the absolute necessity of the patient being completely informed about new drugs being tried on him. In my field of work, hypertensive disease, which involves a large number of functional disturbances, therapeutic trials are difficult to carry out if the patient is fully informed of the disturbances he might have. If we tell him about all the real, but extremely rare, disturbances he might experience during an investigation or the trial of a new form of treatment, we are faced with either a blank refusal to take the test or undergo the investigation or, on the other hand, the appearance of the disturbances we fear. I should like some means to be found of testing drugs with an unquestionable action in valid conditions, while maintaining the freedom of the individual, not endangering his life, and keeping the conscience of the experimenter clear.

Theodor BRÜCKE
member, Austrian Academy of Sciences; professor of pharmacology, University of Vienna, Austria

In Austria therapeutic experiments are permitted in university clinics, but the law forbids them in other hospitals. Thus the patient admitted to a university hospital knows that new procedures not yet in current use may be used for his benefit. This being the case, it is unnecessary to inform him fully; nor is it possible when a new procedure is being utilized. In any case the surgeon, even in current practice, does not tell their patients that an accident occurs in every 10,000 cases. It is undesirable that the patient should know everything, and that is indeed the problem involved in his being informed of a trial to be carried out on him.

Robert de VERNEJOUL
president, Conseil National de l'Ordre des Médecins, France; professor, Faculty of Medicine, Paris

In each "therapeutic" case the decision is one for the conscience of the doctor, who must weigh the risks to his patient and compare them with the risks arising from his doing nothing at all. At present, the most characteristic example is that of the extraordinary rapid progress of organ transplantation surgery. Experiments on healthy people are an entirely different matter. Their sole aim is to advance medical science and they raise a large number of questions. For a great many authorities such experiments should be strictly forbidden; in all such experiments man should be replaced by animals.

The great danger must be pointed out of sacrificing human beings on the altar of science and glorifying subjects who volunteer to be guinea-pigs. Someone has written that voluntary death of that kind is not suicide but a sacrifice in the service of science. Such a view is the more dangerous because it exalts the spirit of sacrifice as an ideal. But the real ideal places the value of human life above all.

However, it must be said that not all experiments jeopardize the life of the subject. Is an experiment on a healthy person that involves little risk acceptable? Many authorities say yes, on the absolute condition that the subject is a volunteer.

The proof of consent has given rise to differences of opinion. To begin with, most experiments in biomedicine are so technical in their details that the subject cannot understand them. When the experiments are such as to involve the subject in a real danger, the question of the volunteer is very controversial. In France, free consent in those circumstances mostly conflicts with our respect for human individuality in life.

Trials on themselves by the experimenters are debatable. Pasteur wrote in 1884: "I have not yet tried to treat people after they have been bitten by mad dogs, but the time to do so is perhaps not far off and I am very tempted to begin with myself, that is, to inoculate the rabies and then stop its effects, so much have I become seasoned and sure of my results."

I shall say nothing about the clinical trials that have been carried out on prisoners condemned to death or on civil prisoners in for a term of years. To me they seem to be contrary to the moral concepts of the human person.

Maurice B. VISSCHER
professor of physiology, University of Minnesota, Minneapolis, U.S.A.

We have some experience with law relating to the regulation of animal experimentation, in the operation of the British Cruelty to Animals Act of 1876. British biologists are in agreement that the Act has had at least one outstandingly useful result. It has relieved them of day-to-day harassment by anti-vivisectionists. It has also undoubtedly been useful in impressing upon students and working scientists the need to exercise care to avoid pain and distress in the animals they use.

On the other side of the coin, however, it has, I believe, greatly hampered medical education because of the restrictions and bars that it places on the use of higher animals by students and also the bars it places on the use of such animals by surgeons-in-training, and it has virtually barred the performance of a number of types of scientific study of animals. Animal experimentation is of such importance to safe clinical investigation that it should never be unwisely impeded.

It may be of interest to point out that British law in general is very permissive with respect to the use of human subjects in scientific study while it is highly restrictive with regard to the use of animals. The great interest in animal welfare is not limited to Great Britain. In the United States today, for example, no popular national movement exists to lobby for regulation of clinical investigation on human subjects, while at least three very well-supported national organizations are clamouring for additional legislation to regulate animal experimentation.

The public has a large interest in avoiding the establishment of conditions which would cripple clinical investigation. It also obviously has a great interest in protecting the rights of individuals. But all unnecessary red tape should be cut and necessary controls should be exercised with the advice of the most competent scientists available to give it.
A BALL TO THE HEART

Where formerly a diseased heart was irreparable, today surgery can often renovate it. Left, performing a delicate though now classic heart operation: after opening up the heart, a surgeon prepares to suture into place an artificial valve (a small plastic ball) to replace the damaged human valve. The ball will move with the pulse of the blood within the confines of a metal cage. X-ray photos, right, show (top) ball closing the aorta while the ventricle fills with blood from the left auricle; and (bottom), lifted by the pressure of blood coming from the ventricle the ball has risen to the top of its cage, allowing blood to pass to the aorta during the systolic contraction that impels blood outwards from the heart. During the surgical operation a machine takes over the action of the patient’s heart and lungs, and blood, diverted from the heart, is pumped through the body after being oxygenated.


In all clinical investigation in which there is any risk to the subjects studied, prior extensive study on many species of lower animals is a sine qua non to safety. Consequently every one concerned about human welfare should be equally solicitous about maintaining freedom of investigators in the humane use of lower animals in scientific study.

Jean HAMBURGER
professor, Faculty of Medicine, Paris; professor, Nephrology Clinic, Necker Hospital, Paris, France

The problem of the voluntary donor of a kidney graft may appear a model for the problems with which we are dealing. On the one hand there is a risk for the donor of 0.12 per cent and on the other a probability of operative success of as much as 75 per cent.

In such circumstances, have we the right to accept the voluntary gift of the donor? Tradition says no, both moral tradition and legislation in most countries holding that it is not permissible to carry out an operation—in this case a nephrectomy—on a subject when it is not for the benefit of the subject himself. But in recent years, I think, everyone has come to agree that in the particular case of the graft of an organ to save a human being about to die such a tradition should not be maintained. All the thinkers and doctors who have dealt with the problem find nothing illegitimate in accepting that a subject should take a reasonable risk to save someone dear to him.

But it is necessary that the doctor should verify two things: first, that there is a reasonable balance between the risk and the probability of success, and second, that the volunteer is a real volunteer...

In June 1967, Italy—the first country in the world to do so, I think—promulgated a law on voluntary donations of kidneys. I think that this is an important example. I think that at present all countries where kidney grafts are commonly and successfully carried out should have regulations protecting the rights of donors and also of the medical profession. At the moment, there is on the whole some illegality in their position.

Alexis de MURALT
president, Swiss National Foundation for Scientific Research; professor of physiology, University of Berne, Switzerland

I have the feeling that there is a great deal of duplication going on at the moment in clinical investigation. I would not say that it should be a government regulation, because I think this would hamper the free development of research, but the idea of having a group of experts, not connected directly with the investigation, to review the problem and issue a licence or give permission, or something like that, seems to me very sensible.

The teaching of clinical pharmacology should be established at every medical faculty. Postgraduate courses on the techniques and the responsibilities of clinical investigation should be organized regularly for the more senior people of the group as well. Because the techniques and the possibilities of investigation are improving every day, new methods come up and the research groups have to be informed about them.

I think that, if a human experiment is undertaken, only the best and the most modern techniques should be allowed. The planning of clinical investigation should be submitted to a review by a knowledgeable body of experts in the particular field involved. And duplication of human experimentation should be avoided if possible, at least within one country, and later if possible in the whole world.
VIEWS OF THE SCIENTIFIC PRESS

TRANSPLANTS: THE SOCIAL DILEMMA
Leader by Dr. Dennis Melrose

The ethical problems raised by our ability to transplant human organs are symptomatic of a much more fundamental advance: man’s new ability to control the course of his own evolution...

So far, [biology] has revealed relatively little about how to overcome the immunological rejection of transplanted tissues.

When, and if, it does we shall have to face a series of complex ethical and legal issues which cannot lightly be brushed aside. Should organs such as the heart be taken from patients who are alive but incurable? Should they be taken only from patients who are dead—and, if so, with what can we replace our now totally obsolete definition of death? If doctors are forced to make such decisions, how are they to reconcile this with their implied undertaking to strive ceaselessly for the life of one patient and not to follow courses of action which they personally believe to be for the most good of most people?

I do not pretend to know the answers. But, perhaps more important, I do not believe that the answers should come from experts involved in the technical issues. Ultimately, they must come from society—from the people who are to donate and to receive transplanted organs...

Here, then, is the crux of one of the most pressing problems raised by modern biology. The scientists whose work gives rise to these issues in the first place cannot disclaim all responsibility for them. Equally, they themselves cannot dictate solutions to democratic societies. Where, then, is the machinery for exposing these situations—which are certain to become more and more common—and where is the machinery for taking action to meet them? Sadly, it does not yet exist. Our ability to control our own evolution, as Aldous Huxley rightly predicted, has overtaken our ability to direct its course in the most meaningful way.

THE ETHICS OF THE CLINICAL TRIALS OF DRUGS
By Sir Derrick Dunlop

There is a general tendency to admit as ethically acceptable the uncontrolled experimentation with unproven drugs to which unsuspecting patients have been continually exposed in ordinary practice; but if in Britain a consultant in hospital... carries out a carefully planned trial in hospital, that is apt to be regarded by certain people as treating like guinea-pigs National Service patients who have right to better things, and questions may be asked in the House of Commons about it. There must always be some patient or group of patients who receive a new drug for the first time; it is surely desirable that this should happen under careful observation by experts in hospital and that the experience of such patients should be made of value to others...

It is therefore not surprising that various authorities have attempted to draft codes of ethics to govern human experimentation—the Nuremberg Code, the Report of the World Medical Association and that of the British Medical Research Council. While it is possible to enumerate some very broad rather platitudinous principles, which are really intrinsic to the doctor’s training, it is doubtful whether precise rules can be framed applicable to all the immensely varying circumstances of clinical trials, about which it is easy to generalize and so difficult to particularize... A rigid ethical ideal may be too restrictive when one is facing real-life problems.

ETHICS, CONSENT AND CONTROLLED CLINICAL TRIAL
By Maxwell Finland
— "Journal of the American Medical Association", Nov. 7, 1966

Considerable interest has been focused recently on the moral, ethical, and legal issues involved in human experimentation...

The more recent thalidomide tragedy spurred the provision of many new regulations to insure the efficacy as well as the safety of drugs. In each of these instances, the uncovering of some major tragedy, and scrutiny of the events leading to it, have resulted in a wider scope of investigation, which revealed other improprieties and, in turn, led to broader and stronger restrictions in the laws and into the regulations provided for implementing them...

Among the recent fallout of these explosive events, there have come some broad accusations as well as specific indictments of immoral and unethical practices in studies carried out by unnamed but readily identifiable investigators. Planned trial in hospital, that is apt to be regarded by certain people as treating like guinea-pigs National Service patients who have right to better things, and questions may be asked in the House of Commons about it. There must always be some patient or group of patients who receive a new drug for the first time; it is surely desirable that this should happen under careful observation by experts in hospital and that the experience of such patients should be made of value to others...

It is therefore not surprising that various authorities have attempted to draft codes of ethics to govern human experimentation—the Nuremberg Code, the Report of the World Medical Association and that of the British Medical Research Council. While it is possible to enumerate some very broad rather platitudinous principles, which are really intrinsic to the doctor’s training, it is doubtful whether precise rules can be framed applicable to all the immensely varying circumstances of clinical trials, about which it is easy to generalize and so difficult to particularize... A rigid ethical ideal may be too restrictive when one is facing real-life problems.

There is a danger that, if scientists do not respond to the public’s concern about research conduct, research rules will be imposed on science from without. Such rules may be formulated in an emotional atmosphere; may be selective, inconsistent, and inadequate; and may be regarded into law in such a fashion as to be unnecessarily burdensome, restrictive and rigid—or even absurd...
Medical researchers consider experiments on animals indispensable to progress in medicine. Here, lymph (a liquid surrounding all body cells) is being collected from a rat in the biological laboratory of a cancer research institute.

The great French biologist, Louis Pasteur, wrote in 1884, when working on a vaccine against rabies: "It is only when I am sure that I can successfully inoculate a number of dogs after they have been bitten that I shall dare to inoculate a human being. And even then my hand will tremble, for what is possible in the case of a dog may not be so when it comes to a human being. However, I shall have no further scientific scruples." In 1964, the World Medical Association affirmed in its Declaration of Helsinki that "clinical research should be based on laboratory and animal experiments or other scientifically established facts."

The click of computerized medicine

(Continued from page 17)

much more complex to master than man-machine problems. But the exchange of information between doctors of various countries has become much easier. The world has grown smaller because of the impact of the computer on instantaneous translation and because of improved communications. A universal medical language and common vocabulary is nearly established.

The computer industry has become as important to life in the year 2000 as the automobile used to be. Many individuals in society are engaged in producing and servicing computers, while others develop systems of communications and expand the range of commands and controls.

As well as being used in the health service, computers have had their impact on leisure time, for personal computer education in many subjects has led to an overall advance in human knowledge. This has had its impact on the medical services, for many patients have had the benefit of health education using special computer programmes of instruction.

Also the general level of medical knowledge has been considerably improved by better instruction at school and in the health centres using computer techniques. The increased awareness and knowledge of the problems of preventing disease have made it possible to educate patients to alter their habits so that they lead healthier and fuller lives.

Preservation of mental and emotional well-being has become a major objective in health services. Computer techniques have enabled man to explore mental mechanisms and emotional problems further, once a proper vocabulary was accepted. Much more information about the inheritance and acquisition of emotional traits throughout life has been obtained using computers to record and analyse the large amount of data available.

Doctors and nurses still advise, comfort and treat their patients. The mysteries of disease have not all vanished and many difficult problems remain. Yet the computer has proved an essential tool in dealing with the many details which would otherwise take a great deal of human labour, reducing the economic problem of caring for the sick to measurable proportions. It is only the use of computer techniques at an advanced level that has made advances in health services possible without increasing national expenditure and ultimately the burden on everyone's budget.
How's the world's health?

Cardiovascular diseases

Cardiovascular diseases are major killers in highly developed countries. In 1967, a WHO study of 23 industrialized countries showed heart diseases as the leading cause of death; heart diseases and "strokes" were responsible for more than 45 per cent of all deaths. With the rise of the standard of living, developing countries may soon be confronted with similar problems.

Some cardiovascular diseases are found everywhere, others only in certain geographic areas or among identifiable groups of people. Comparative studies are under way in Jamaica, in the Polynesian islands, in Peru, among people living at high altitudes, and elsewhere.

WHO also studies spontaneously occurring conditions in animals comparable to cardiovascular diseases in humans. Certain primates are excellent models for human atherosclerosis of the aorta and coronary vessels while some birds develop lesions similar to those in humans.

Mental health

Mental illness rates rise as man goes to live in the city. Suicide is among the first ten causes of death in many countries and the rates for attempted suicide are increasing. A survey of 85 countries revealed a critical shortage of psychiatrists. Eight had none at all and in another 35, with a total population of 880 million, there was less than one to 200,000 people.

There is also an alarming increase in alcoholism and drug abuse involving depressants, stimulants and hallucinogens such as LSD. The trend is toward a combined approach to the problems of dependence on alcohol and other drugs; a WHO Expert Committee pointed out the similar ties in cause and treatment as well as the frequent transfer from one drug to another.

Venereal disease

This is on the rise and has reached post-World War II levels in some countries. There are about 60-65 million new cases of gonococcal infection each year. Syphilis is also increasing and a careful U.S. survey discovered that only about 11.3 per cent of cases of infectious syphilis were reported.

WHO has provided direct assistance to strengthen VD control in 40 countries, granted training fellowships and research grants. In 1966 reference strains of gonococci were distributed to national laboratories from the newly-established WHO Reference Centre for Gonococci in Copenhagen.

International quarantine

Of the six quarantinable diseases, two, typhus and relapsing fever, seem to present no longer any international danger and may soon be dropped from the list of diseases subject to quarantine. The situation for the four others is:

Plague, after declining in the late fifties, is on the upswing; the Republic of Viet-Nam is the hardest hit with 4,532 suspected cases reported in 1967. No vaccine has yet been developed as an effective preventive measure. The plague does not seem to be spreading internationally, but vigilance is necessary.

Yellow fever still occurs in tropical Africa and America; an outbreak in Ethiopia caused over...
3,000 deaths in 1961. Yet yellow fever vaccine affords complete protection.

Smallpox seems to be rising again. Here again proper vaccination is effective and WHO is tightening up the regulations. The International Certificate of Vaccination against smallpox now requires vaccine up to WHO standards and the origin and batch number of vaccine used; a doctor’s signature is also needed.

Cholera is on the march in Asia. It has been reported from the Philippines in the East to Iran and Iraq in the West. Vaccines are only partially effective.

International sanitary regulations

WHO constantly reviews the International Sanitary Regulations in an attempt to keep them abreast of world conditions. The new health regulations for international trade and travel will go into effect, if approved by the World Health Assembly, as of May 1968. They will extend medical health services not only in international ports and airports but inland wherever large movements of population occur. The object remains to speed trade and travel while safeguarding health.

Tuberculosis

Some 15 million people still suffer from active tuberculosis and may infect some 50 million children and adolescents. More than three-quarters of these cases are in developing countries. Each year two or three million new cases appear and between one and two million people die of this disease. Yet the past 20 years have seen a quiet revolution in dealing with this disease. New knowledge has led to new techniques which now offer hope to poorer countries fighting tuberculosis.

Each effective immunization with BCG costs as little as 10 to 20 cents. The discovery of INH (isoniazid) allowed a major change in treatment. Today, patients can leave hospitals and by taking this medicine return to a more normal life in the community.

A WHO Expert Committee stressed new techniques which through complete immunization and ambulatory chemotherapy could reduce tuberculosis to a minor public health problem within the next two or three decades.

Malaria

Malaria is on the retreat: 1,304 million or 78 per cent of the people living in originally malarious areas are now protected from the disease. Malaria has been eradicated from very large parts of the Americas and all of continental Europe. By 1967, 90 per cent of India’s population was living in areas freed from the transmission of malaria. Yet trouble areas remain.

Malaria is still the major health problem in Africa south of the Sahara; more than half the children under three and virtually all of the population over that age is affected.

There have been setbacks and reintroduction of malaria in various regions. Resistance to DDT has been observed in mosquitoes. Some programmes have slowed down or stopped for lack of funds. Yet success must be total since even one case can start the cycle of re-infection again.

Increasing productivity and decreasing the amount spent on medicine and lost through illness may prove to be the best investment the world community has made.

Quinine for malaria used to cost Greece $1,300,000 a year; fighting disease with DDT in the 1950s only $300,000. Results: since 1960 no deaths have been reported, land has been reclaimed, labour is more productive and the rate of malaria has dropped to zero.

Since 1955, WHO has embarked on the first disease eradication venture in history and man’s largest public health project—world-wide malaria eradication. Regardless of how long it takes, WHO goes ahead with its world-wide programme for eliminating malaria.

Smallpox

Smallpox can be eliminated: Yet up to 100,000 cases are still reported annually. Seventy per cent of the world’s cases reported in 1966 occurred in South-East Asia and the disease remains endemic in all countries in Africa south of the Sahara and many other countries.

Three areas remain free of smallpox—Europe, North and Central America and the Western Pacific.

Individually, in co-operation with others, and now under a world-wide programme launched by WHO in 1967, nations are fighting smallpox and they are pushing it back. Burma, for example, began eradication in 1962 and by 1966 did not have a single case to report. India and Pakistan have mass campaigns well under way already producing results.

Jet injectors, pistol-like machines which project vaccine at high pressure, already in use in Africa and Brazil, allow up to 1,000 vaccinations an hour. WHO has set up an emergency stock of vaccine and jet injectors in Geneva which can be flown in a few days to any disease-free area menaced by the re-introduction of smallpox.

Smallpox-free countries are helping with gifts of vaccine, particularly the U.S.A. and the U.S.S.R., but 1,100 million people run the risk of smallpox and about 2,000 million vaccinations and revaccinations are needed for the ten-year period.

Polio and measles

Although poliomyelitis has practically disappeared from one half of the world—in 16 countries in Europe with good immunization campaigns the average annual incidence of poliomyelitis from 1961-64 dropped by about 99 per cent—it may be increasing in the other half as environmental con-
ditions in the developing countries change. The use of vaccines in such countries has brought to light problems of organization and also of the effectiveness of vaccine which have not been solved. Polio vaccine seems to be less potent under tropical conditions.

Measles vaccine, though effective, costs too much for most of the countries where measles still represents an important cause of death in childhood.

WHO has been actively associated with the development and testing of poliomyelitis and measles vaccines, two of the most effective immunizing agents yet produced. More work will be necessary to adapt them to the difficult climatic and economic conditions that affect more than half of the world's population.

Leprosy

About 11 million cases in the world yet the number of registered patients is only a little more than 2.8 million and of these about 1.9 million receive treatment. Almost four million people are disabled by the disease.

Water, basic to life

Contaminated water spreads many diseases, directly and indirectly through breeding insect-carriers. Typhoid, cholera, amoebic and bacillary dysentery are some of the illnesses transmitted by dirty water.

In the developing countries infectious and parasitic diseases rank as the principle cause of death. Chief among them are diseases of the gastro-intestinal tract which account for a majority of diagnosed deaths in most of the 17 countries studied by WHO in Africa, South and Central America and Asia.

It is estimated that one out of four hospital beds in the world may be occupied by someone suffering from such water and filth-borne diseases; they are also one of the chief killers of infants and children in developing countries.

WHO is the executing agency for a number of United Nations Development Programme Special Fund projects which draw up engineering and feasibility reports covering sewerage and rate paying as well as water supply; the plans for Accra-Tema in Ghana, where a rapidly growing urban and industrial area of 500,000 inhabitants is expected to reach 1.5 million by 1980, are a good example. Work is also going ahead on master plans for Calcutta, Istanbul, Kampala and Malta; in 1967, there were 207 WHO-assisted projects in 83 countries.

If only clean water could be supplied to everyone, diseases which kill and sicken millions could be eliminated without medicine, without mass campaigns or wonder drugs.

Parasitic diseases

An estimated 200 million people are affected by schistosomiasis (bilharziasis), 190 million with filariasis (which may cause elephantiasis), 450 million with hookworm, 50 million with onchocerciasis (river blindness) and seven million with Chaga’s disease (a form of sleeping sickness confined to the Americas).

Trypanosomiasis (African sleeping sickness) makes agriculture and stock-raising impossible over more than ten million square kilometres of fertile land in Africa.

WHO tries to apply the most modern medical and scientific findings to control parasitic diseases and prevent their spread. Unfortunately, laboratory and field research is hampered by the scarcity of trained national staff. Therefore, their training in the use of effective new techniques is receiving high priority.

Trachoma

The world’s most common cause of blindness affects as many as 400 million people.

On guard against pollution

WHO is helping to establish worldwide networks to monitor air pollution and to check the levels of radioactivity to which populations are exposed; long-term effects of low doses of radioactivity are also being studied. Water pollution is another major source of concern and activity.

Children in peril

In developing countries infant mortality may be ten times higher than that in advanced countries; rates for mortality may be thirty to forty times higher.

(Information: World Health Organization)
CASIMIR ZORAWSKI
AND MARIE SKŁODOWSKA

Sir,
I enjoyed reading the article by Professor Leopold Infeld ("Maria Skłodowska: The Dreamer in Warsaw") in your Oct. 1967 issue, and notably the account of the part played by my grandfather in Maria Skłodowska-Curie's decision to take up a scientific career.

May I point out a slight error. My grandfather's name was not Karol, but Konimierz (Casimir), and his surname was spelt Zorawski (phonetically: Jorawski). In addition to the theorem in hydrodynamics mentioned in the article, my grandfather's achievements in science comprised some 70 in pure mathematics and the application of differential equations to geometry and physics.

Casimir Zorawski's scientific accomplishments led to his appointment as professor and later dean and rector of the Jagellonian University, Cracow. He also became an honorary professor at the University of Warsaw and was made a member of the Polish Academy of Sciences and Letters and of the Czech Royal Association of Sciences and Letters as well as an honorary member of the Polish Academy of Sciences in Warsaw.

Casimir Zorawski
Warsaw, Poland

‘MAHABHARATA’ WITH 5,000 PAGE INDEX

Sir,
I read and admired your splendid issue devoted to the Mahabharata and the Ramayana (Dec. 1967). Through the International Council for Philosophy and Humanistic Studies, Unesco has made and continues to make a major contribution to the planning and publication of a multi-volume annotated edition of the Mahabharata. Sponsored by numerous universities and by the governments of several Indian states, the edition has been prepared by the Bhandarkar Oriental Research Institute in Poona, India. This edition of the Mahabharata, which is the world's largest literary composition (eight times the size of the Iliad and Odyssey combined), comprises 22 volumes totalling 13,000 pages. The 22 volumes have been published, and it now remains to prepare the index to the work. This alone will be a formidable task since the index is expected to cover about 5,000 pages.

Jean d'Ormesson
International Council for Philosophy and Humanistic Studies
Paris, France

TWO GREAT EPICS OF ASIA

Sir,
Congratulations and thank you for your truly excellent issue which featured the Ramayana and the Mahabharata. I have been a long time admirer and enthusiastic supporter of the "Unesco Courier". I believe that your magazine is one of the very best sources for helping teachers and students to develop empathy about peoples and cultures.

Seymour H. Fersh
Education Director
The Asia Society
New York, U.S.A.

Sir,
I have seen the special issue of the "Unesco Courier" on the Ramayana and the Mahabharata and find it extremely well done and impressive. Please accept my most sincere congratulations. I am sure that this issue will have the greatest success in the world and will contribute to a better understanding of Indian culture.

E. Pouccha Dass
First Secretary (Ifl.)
Embassy of India, Paris

FOR ‘BHAGAVAD GITA’ READ ‘BHAGAVATA’

Sir,
I should like to point out a small misprint which has crept into my article "Kathakali and the Dance Drama of India" (Dec. 1967). The word Bhagavata in the original has come out as Bhagavad Gita in print. Bhagavata Gita is only an episode and part of the Mahabharata whereas Bhagavata is one of the famous eighteen Puranas. Therefore the word Bhagavada, wherever it appears in the printed article, should be read as Bhagavata.

C. Kunchu Nair
Principal, Keralaalamandalam Shoranur, Kerala State
South India

EXPLOITATION OF GEOTHERMAL POWER

Sir,
You may be interested in recent research conducted here at Wairakei, New Zealand, into the exploitation of geothermal fields for electric power. At present a power station producing 175 MW (electric) is drawing about 175 million tons per year of fluid from a pressurised hot water aquifer while a second area is under study for such employment.

The first research result concerns the determination of an optimum well-head pressure for different types of reservoir, whether containing superheated steam as in Italy and California or hot water as in New Zealand, Mexico, U.S.S.R., Japan, El Salvador, the Philippines, etc. As the latter kind of reservoir is by far the more common and exploitation would be considered where the water temperature exceeds 200°C, the fixing of the wellhead pressure at 75 lb/sq. in. gauge has a very wide application and not only increases the life of the field but reduces capital costs. This work has recently been published.

The second investigation, applicable to hot water reservoirs, is concerned with the future transmission of concurrent steam-water mixtures through long pipelines, of 3 foot diameter, connecting the production field to the power station. Such large scale two-phase transmission has never before been attempted before, but both theory and recent confirmatory tests indicate that there is no particular difficulty involved such as that due to the effects of water hammer or cavitation. The results show that a staggering seventy-five per cent increase in power can be obtained compared with the Wairakei system and this will lead to a significant reduction in the cost per kilowatt for a second generation plant.

Thus for the pleasure of a few many millions of dollars, the New Zealand Government has been able to provide a new source of energy, both for the country itself and for export, and to increase the use of water power in the world by an amount far in excess of the previous maximum use of water power in the world.

R. C. B. Oliver
Llandrindod Wells
Radnorshire, U.K.

THE AFRICAN GENIUS

Sir,
I wish to say how much I enjoyed "Africa and the African genius" (June 1967). I was all the more disappointed to find your list of books in "Afri-

The second investigation, applicable to hot water reservoirs, is concerned with the future transmission of concurrent steam-water mixtures through long pipelines, of 3 foot diameter, connecting the production field to the power station. Such large scale two-phase transmission has never before been attempted before, but both theory and recent confirmatory tests indicate that there is no particular difficulty involved such as that due to the effects of water hammer or cavitation. The results show that a staggering seventy-five per cent increase in power can be obtained compared with the Wairakei system and this will lead to a significant reduction in the cost per kilowatt for a second generation plant.

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R. C. B. Oliver
Llandrindod Wells
Radnorshire, U.K.

NOISE POLLUTION

Sir,
Your July 1967 issue described many kinds of "noise pollution". Every two years, on the occasion of a large exhibition in my home town, helicopter flights take place, and day after day the ugly "birds" swoop low over the roofs, over schools and hospitals. Thus for the pleasure of a few many have to suffer in terms of health and tranquility, and schoolchildren cannot concentrate in their lessons.

Günther Grafen
Ravensburg, Fed. Rep. of Germany

Letters to the Editor

33

...
Atomic power station beyond the Arctic Circle

An atomic power station now being built in the Soviet Far North, on the Kola peninsula between the Arctic Ocean and the White Sea, will be the most powerful in the U.S.S.R. At present 500,000 cubic metres of rock are being removed to make place for its foundations, and work has been going on throughout the polar darkness under the glare of searchlights.

Over 341,000 students abroad

More than 341,000 young people are studying outside their own countries reports "Study Abroad," Unesco's publication listing fellowship opportunities for students (Vol.XVIII: 1968-70; $5.00, £2.50). The U.S.A., France, Fed. Rep. of Germany, U.S.S.R. and U.K. together are responsible for almost half of all foreign student enrolments and 40 per cent of all fellowships. "Study Abroad" lists (in English, French and Spanish) some 215,000 fellowships offered through the 1969-70 school year.

'FAO Review' — new focus on world food problems

The U.N. Food and Agriculture Organization has just published the first issue of "FAO Review," a 68-page bi-monthly magazine, appearing in English, French and mathematics. The experiment is proving highly successful in broadening students' knowledge and in inspiring students to specialize in scientific subjects.

Taught by top scientists

The Municipal Service of National Education in Riga, Republic of Lithuania, has organized a new scheme to arouse interest in modern science among secondary school students, by inviting top scientists and Academicians to give special courses in modern science among secondary school students.

A road-link between Denmark and Sweden

A joint Danish-Swedish survey team has recommended the early construction of a bridge or tunnel across the Sound that separates Denmark from Sweden. Surface traffic between these countries, today dependent on ferry services, more than doubled between 1955 and 1966.

'World Studies,' a U.K. educational quarterly

We call readers' attention to "World Studies Education Service," a new quarterly bulletin published in England, devoted to the role of education at all levels in promoting a better understanding of the world and world affairs. Recent subjects dealt with include "Race in the Curriculum," "Teaching about Human Rights" and the teaching of world affairs to the very young. Annual subscription 42/- payable to the Editor, Dr. James L. Henderson, Senior Lecturer in History and International Affairs, University of London Institute of Education, Malet Street, London W.C.1.

Help for the Javan rhinoceros

The world's rarest large mammal, the Javan Rhinoceros, is now to be found only in the Udjong Kulon Reserve in Indonesia. The World Wildlife Fund has sent a Belgian specialist, Dr. Jaques Verschuren, to organize a long-term programme for the development and management of the Reserve, in collaboration with the Indonesian Government.

UNICEF aid to education

Last year, UNICEF was devoting 24 per cent of its funds to support educational and vocational training projects in the developing countries, compared with only 7 per cent six years ago. The aid helped to buy textbooks and school equipment, to train teachers and to instruct young people in skills and trades.

International course in bacteriology and immunology


Flashes...

- About 55 million gallons of fresh water are now distilled daily from the world's oceans, says a report from a London symposium on water desalting.
- The 25,000 school textbooks from 110 countries in the library of the International Bureau of Education (Geneva) are believed to be the only such collection in the world.
- An Association of African Universities with headquarters in Addis Ababa has been set up to encourage exchanges and cooperation between the continent's colleges of higher education.
- A network of pipelines 5,000 kilometres (3,000 miles) long is being built to bring natural gas from the rich newly-discovered Tiumen deposits in Western Siberia to other parts of the U.S.S.R.
Just published

8th edition, revised and enlarged, of Unesco's

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PLASTIC LUNGS FOR MEDICAL RESEARCH

Plastic casts of blood vessels and air passages in the lungs are now being produced to help medical research in pulmonary diseases. Cast is made by injecting liquid plastic under pressure into all or part of a lung removed by surgery. When plastic hardens lung tissue is removed leaving a perfect three-dimensional cast. This permits a fine analysis of the arterial, veinous and bronchial tube circulation in the lung and enables doctors to study how lesions are formed and develop. Study of casts has helped to localize by X-ray, lung abscesses, thrombosis and other diseases. Photo shows scientist examining plastic bronchial tubes. Some casts have been made of blood vessels so tiny that they are visible only through an electron microscope.