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elements, and when this principle was translated into particle physics, it came out as a statement that the subatomic particles were built out of various combinations of three ultra-elementary particles to which Dr. Gell-Mann gave the whimsical name of quarks. Among non-physicists, he is better known for that than for the multiplet groupings.

A search for quarks began, with each of the world's largest laboratories taking its turn. After seven fruitless years an Australian team has entered a claim to the discovery of a quark (SN: 9/13, p. 198), but the claim is regarded with skepticism pending the submission of more evidence. □

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was the inconsistency of cyclohexane. Sometimes one form was more stable than another form; at other times it was less stable. Conformational analysis resolved the problem, giving organic chemists a way of telling which conformation of a given structural arrangement would be more stable and which more reactive.

Conformational analysis thus became important in planning the synthesis of complex substances and in analyzing exactly what happens in a chemical reaction.

But its consequences are not limited to chemistry alone. It is significant in understanding biological processes, such as how substrates fit on enzyme surfaces. And perhaps the outstanding discovery of the last decade—the double-helical shape of the DNA molecule—ultimately rests on conformational analysis.

Dr. Barton carried his studies into the plant world, where he unraveled a number of sequences of the steps a plant goes through to make alkaloids, nitrogenous compounds of vegetable origin which in small quantities have profound biological effects. Another of his achievements, which earned him the American Chemical Society's 1957 Fritzsche Award, was the determination of the structure of caryophyllene, the chief chemical constituent of oil of cloves.

In the field of photochemistry, he discovered certain photolytic reactions, specifically the breakdown of nitrides of alcohol by light. The discovery eventually led to the synthesis of difficult and complex molecules.

Of Dr. Barton's winning the Nobel Prize, Dr. Gilbert Stork, professor of chemistry at Columbia University and at one time a colleague of his, says, "It was exceedingly reasonable that he would get it. Everyone knew he would get it, the question was when." □

IMMUNE RESPONSE AND CANCER THERAPY

In the fight to bring rampaging cancer cells under control, the idea of stimulating the body's defense to combat what is in fact a foreign substance is simple and appealing. It is the principle behind the development of vaccines against many of man's afflictions, from smallpox to polio to German measles. It has even been tried by some Russian immunologists against leukemia (SN: 8/30, p. 161).

The dream of a cancer vaccine is still just that—a dream. But experimenters at Emory University in Atlanta have shown that the basic mechanism—stimulation of an immune response—can take place.

"Man," says Dr. Loren Humphrey of Emory, "can react against cancer."

Dr. Humphrey's team injected an experimental substance, made of killed cancer cells from other patients' tumors, into 70 incurable cancer patients. About 20 percent of the patients have had some response, and in cases where the patients were estimated to have at least a year to live, the response rose to 50 percent. The reactions ranged from stopping the growth of the tumor to causing it to shrink, and in some cases to disappear altogether. Improvements have lasted from 4.3 months up to two years.

The theory behind the procedure assumes that cancer patients build an immune factor which is contained somewhere in the blood. "We don't know whether the factor is in plasma or white blood cells, so both are used," Dr. Humphrey told a meeting of the American College of Chest Physicians in Chicago.

To make the preparation, a part of a tumor is excised from one patient, and the tissue, including plasma and white cells, minced and frozen to render it acellular. The homogenate is then injected into another patient with the same blood type.

In one patient with inoperable cancer of the colon, the tumor disappeared. "She has been free of the disease for two years now," Dr. Humphrey says. Another, a man suffering from a malignant melanoma, a vicious cancer that affects the skin, has been free of the tumor for 14 months after treatment with the vaccine. The prognosis for the others, however, is not nearly so promising. The majority of the cases are terminal, having failed to respond to either surgery or X-rays. And even in those in whom there was some remission, it has not been enough to make a difference.

But the overall result justifies further work.

"The fact that an occasional excellent response is obtained in some patients justified the effort of developing the vaccine," says Dr. Charles R. Hatcher Jr., also of Emory University, and who is working with Dr. Humphrey on the vaccine. "We hope to see if it's a safe vaccine—then use it in patients earlier in the course of the disease."

FORECAST AND SOLUTION

To fill the world's belly

FAO

Famine: More to come in 20 years.

For years agronomists and population experts have predicted that the world's supply of people will outrun its supply of food sometime before the end of the century (SN: 2/12/66, p. 102). The experts agree that the result will be massive starvation in the underdeveloped nations of Asia, Africa and Latin America, but agricultural and population statistics have been too vague to predict just when the crisis will occur.

The United States has exported vast amounts of surplus food to obviously desperate countries like India and supplied underdeveloped countries with birth control information and technical assistance in devising better agricultural techniques. American agronomists have helped develop new varieties of cereals that yield two and three times

the normal crop. Yet so far there has been no way to estimate whether any of these measures can avert disaster. There has not even been a coordinated plan of attack.

This week, however, the United Nation's Food and Agricultural Organization will present representatives from more than 100 nations, including the United States, with a detailed plan for preventing world famine. The plan, known as the Indicative World Plan for Agricultural Development, contains the most specific predictions about the future of the world food production that have ever been attempted, and recommends the first overall scheme of action which the developed nations can adopt to combat famine.

Essentially, the plan is a model of the current world agricultural situation, including factors such as population growth and industrial development which affect agriculture. By projecting current trends, the model offers a picture of global food problems for the next 20 years. The model also makes it possible to predict the probable effects of antifamine programs.

Even though statistics on agriculture and population in the underdeveloped countries are notoriously weak, the plan, which has been in the making for the last six years, provides the most accurate forecast possible.

The forecast is, as expected, grim. Between now and 1985, 85 out of every 100 people born will live in underdeveloped nations. These nations will have to increase their food supplies at least 80 percent to avoid famine. The rising income of the underdeveloped nations actually makes matters worse: As people become wealthier they demand more food, so the total increase in demand for food by 1985 will be closer to 140 percent.

The Indicative World Plan calculates birth control programs will have a negligible effect on the problem. Nor will the importation of food from food-surplus countries be much help. In order to meet their food requirements, underdeveloped nations would have to import some $26 billion worth of food annually by 1985. Politically and economically, importation on that scale is out of the question.

The only hope, therefore, is for the underdeveloped countries to increase their own agricultural production. If the new strains of high-yield cereals were extensively used, the output of staple grains by 1985 could be doubled. Such an increase, the plan predicts, would be sufficient to prevent a catastrophic famine. Although the immediate result of a doubled grain supply would be to reduce prices, thus leaving many farmers even poorer than they were before, the reduced prices would make it possible to use the grains as livestock fodder, and so to improve the supply of meat.

At first glance, this seems like an optimistic prediction. But the plan makes it clear that agricultural technology by itself will not be enough. The high-yield grains cannot be used without fertilizers, irrigation systems and greatly expanded marketing facilities. Moreover, there is a limit to the number of people who can efficiently work a given area of land. The underdeveloped countries will have to undertake major expansions of the non-agricultural sectors of their economies simply to provide jobs for people who cannot be employed on farms.

None of this can be done without the assistance of the wealthier nations. One of the major recommendations of the Food and Agricultural Organization is that developed countries like the United States expand their assistance to impoverished nations beyond the realm of agricultural technology. The plan urges, for example, that rich nations make substantial trade concessions in order to provide the underdeveloped countries with more foreign exchange.

In the past the United States has reacted unfavorably to such recommendations. Many of the goods that underdeveloped countries want to export, such as sugar, cotton and cereals, the United States prefers to produce itself or to import under the protection of tariffs.

The Food and Agricultural Organization is neither politically powerful nor popular. It believes that world famine can be avoided. But whether its recommendations, to be made at a conference in Rome this week, will be adopted, depends finally on whether the well-fed world wishes to alter the future pictured in the Indicative World Plan. □

TEKTITE II

Science from a habitat

Manned habitat projects have so far tended generally to be oriented to testing the technology of underwater life-support systems, and demonstrating man's physiological and psychological ability to live and work under the sea for extended periods.

This was natural enough; the sea floor still has to be regarded as an alien environment for man. Yet earlier this year four aquanauts stayed two months below the surface of Great Lameshur Bay off St. John in the Virgin Islands in the highly successful Tektite I project (SN: 2/15, p. 161). As a result many scientists felt the time was then ripe for the next step in underwater habitat operations: an emphasis on basic scientific studies making use of men's ability to stay on the sea floor.

Such a project is about to begin, and scientists from all over the country are being invited to submit proposals for participation.

The project, Tektite II, will use the same habitat and be carried out in the same location and depth, 50 feet, as was Tektite I. But there are fundamental differences.

Tektite II will be the most ambitious underwater exploration program ever attempted. Over a span of seven months, beginning sometime next spring, more than 50 scientists will spend between two and three weeks each beneath the surface, which could not have been done with any confidence the first time around.

"Tektite I established the fact that man can live and work safely in undersea habitats," says Richard A. Waller of the Department of Interior. "But a one-shot 60-day project is not enough to provide continuity to any kind of scientific research. Tektite II will allow the scientific programs to be extended over seven months, and expose great numbers of scientists to this approach for research." Waller, chief aquanaut during Tektite I, is deputy project manager for Tektite II.

Like its predecessor, Tektite II will be a cooperative effort of several Government and private organizations. But this time, with the shift in emphasis to marine studies, the lead agency responsibility has shifted from the Navy to the Department of Interior. Management of the scientific program has been given to the Smithsonian Institution. This week the Smithsonian began calling for proposals.

Although the entire Tektite II operation is expected to cost about $1 million, the Smithsonian will support the work of the 50 undersea scientists with some $50,000 of additional funds obtained from private sources.

In addition to the main habitat, which is now being refurbished at the Philadelphia Navy Yard, a smaller, two-man habitat, yet to be built, will be placed at a depth of 100 feet to determine whether a nitrogen-oxygen breathing mixture can safely be used at that depth.

Tektite I demonstrated that nitrogen was safe at the shallower, 50-foot level. A nitrogen-oxygen mixture has many advantages over helium-oxygen at shallow depths, but beyond about 100 feet the nitrogen mixture thickens so that breathing becomes difficult. □