showed similar resonances. Such states are shown in Table 2. In 1962, when only the Δ (1238) and Σ_{10} (1385) were known, Gell-Mann predicted the existence of the Ξ_{10} (1532) and the Ω^- (1679). When these particles were found, and, in particular, when the Ω^- was found, in 1964, there was no question about the importance of this theory. This theory is incidentally also the one which led Gell-Mann, following a remark by Robert Serber (and, independently, George Zweig), to speculate on the possible existence of entities called by him "quarks," which might be thought of as fundamental building blocks of the particles themselves. The basic idea of particle classification according to the group SU(3) was published virtually simultaneously by Yuval Ne'eman, who had been working at Imperial College with Abdus Salam.

One could go on and talk about Gell-Mann's very important work called current algebra, first proposed by him in 1961 but actually published in 1964. This is, however, too technical. Instead, let me conclude with a few remarks about Gell-Mann's extracurricular interests. He is fluent in several languages, knows individual words in very many (although he is known, experimentally, to be quite deficient in Erse), has a deep knowledge of linguistics, and is insistent about proper pronunciation of foreign words, such as saying always "Fe*r-r-r*-mi" instead of simply "Fermi." He has been a life-long bird watcher and hiker-camper and has recently become seriously involved with problems of the environment. He helped organize a summer study in 1969 sponsored by the Environmental Studies Board of the National Academy of Sciences. He is currently a member of the President's Science Advisory Committee.

The Nobel Committtee has done itself proud.

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The Population Crisis: Rising Concern at Home

Mention of the impending world population crisis usually has evoked images of undernourished, famine-threatened villagers of underdeveloped countries such as India, Egypt, and Haiti. Now, however, population growth is coming to be viewed as a serious domestic as well as a world problem. With only 204 million inhabitants in a territory of continental size, the United States is, by comparison with many nations, thinly populated; but the concentration of people in the larger urban areas, especially those of the Northeast, California, and the Great Lakes states, is making many Americans uneasy about the chamber of commerce belief that bigger means better.

Increasingly, it becomes evident that bigger is likely to mean more urban sprawl, more air and water pollution, more traffic congestion and teeming ghettos, and more overcrowding in schools and recreation areas. And, if 200 million Americans are too many, what about 300 million, the number forecast for the year 2000, or 400 million, the population forecast by some for 2040?

The fact that rapid population growth inevitably aggravates (and is often the major cause of) a variety of environmental and social problems promises to hasten the latest transformation of the birth control issue which has undergone a remarkable evolution since the turn of the century. That issue was first taken up by the feminists. Later, many physicians also became interested because they viewed the legal prohibitions of some states against the prescribing of contraceptive methods as an infringement upon their professional rights and responsibilities.

Then, within the last decade or so, many people (and an increasing number of politicians) began to proclaim, as basic to human dignity, the right to decide whether to bear a child or not —and, in so doing, they transformed birth control into something politically respectable. Now, finally, the issue becomes one of broad concern, of interest to all who see the population expanding—currently at a rate of about 2 million a year—without regard to the future availability of resources or to the effect on the quality of life.

This year members of Congress have, by the score, been proposing or cosponsoring legislation intended to increase the effectiveness of family planning programs or to establish new government agencies which would develop policies aimed at keeping population and resources in balance. For example, in May, Senator Joseph Tydings (D–Md.) introduced a bill to establish in the Department of Health, Education, and Welfare a national center for population and family planning which would take over direction of the programs of birth control research, training, and services which are now scattered throughout HEW. At last count, 24 senators and 64 representatives were cosponsoring the Tydings bill and its companion measure in the House. On 23 October, HEW announced that it was setting up a National Center for Family Planning, thus responding to the congressional pressure (though reorganization planning had been under way for some time).

Other legislation, introduced by Representative Emilio Q. Daddario (D–Conn.), a Catholic, and Representative Charles A. Mosher (R–Ohio), would redesignate (and reorient) the Department of the Interior as the Department of Resources, Environment, and Population. This measure is being supported, as a vehicle for discussion if nothing else, by the Republican Task Force on Earth Resources and Population, a group set up last April by House Republicans under Representative George Bush (R–Texas) as chairman. Interest in this and other population measures not only cuts across party lines but, within each party's ranks, reaches to both the conservative and liberal ends of the spectrum.

In July President Nixon sent to Congress his message on population problems—the first presidential message ever devoted entirely to the population issue. Although the message was concerned partly with programs of assistance to birth control efforts in the developing nations, it dwelled at length on the matter of the mounting population pressures at home. The President

asked Congress to authorize the establishment of an advisory Commission on Population Growth and the American Future. This body, which would have 2 years to prepare its report, would be expected to predict the probable course of population growth and distribution over the next 30 years. Also, it would offer forecasts and recommendations as to the impact of population growth on the various levels of government and as to the actions government must take—in school construction, highway and recreation planning, and the like—if that growth is to be accommodated.

Other recommendations in the President's message called for expanded and better coordinated programs of research, training, and services in the family planning field. The President observed, particularly, that an estimated 5 million low-income women of childbearing age—a figure which some population specialists regard as much too high—lack adequate access to family planning services. (Last week, the Office of Economic Opportunity, which administers the poverty program, announced plans to double the size of its family planning program, which now reaches 350,000 women.) Nixon said that the effects of world population growth on the environment and food supplies "call for careful and immediate action," and added that his Environmental Quality Council would take up these problems.

The President emphasized that, while no one should be denied family planning assistance, the religious convictions and personal wishes of all with respect to birth control and family planning would be respected. This was his way of trying to avoid the dilemma that confronts every politician who deals with the population problem. Nothing is more private than people's sex habits and their desires about having children, yet nothing has greater consequences for the public at large than a rapid rate of population growth.

This paradoxical situation is especially troublesome in the United States, where middle-class parents, already having easy access to effective contraceptive methods, are producing most of the new babies. There is debate among population specialists as to the impact that an extension of family services to all can be expected to have. But some believe that, in terms of reducing overall population growth, such action will produce small results. In their judgment, the government should commit itself immediately to the goal of a zero rate of population growth and to the task of obtaining, by one means or another, popular acceptance of the two-child family as the national norm (the three-child family is currently the norm).

The Nixon message fell far short of that prescription. Yet, to see just how far federal population policy has come in the past decade, one need only recall President Eisenhower's remark in 1959 that birth control is most emphatically not the government's business. If anything is clear about Nixon's policy on the birth control issue it is that it represents a reversal of the total negativism of the Eisenhower years. Yet, in Congress, his message seems to have outraged no one. On 29 September his proposal to establish a population commission was routinely approved by the Senate, and this measure is likely to receive House approval by early next year.

Further evidence of a growing interest in the population problem can be seen in the gradual emergence of an alliance between, on the one hand, population groups such as Planned Parenthood/World Population, the Population Council, and the Population Crisis Committee and, on the other hand, conservation organizations such as the Sierra Club, the Wilderness Society, and the National Wildlife Federation. A few conservation groups, especially the Conservation Foundation and the Sierra Club, have shown considerable interest in the population problem in the past, but generally the conservation and population movements have gone their separate ways.

Now, however, these movements are reaching out to one another. The Izaak Walton League of America, for example, will focus on population pressures on the environment when it holds its annual convention next July. And several conservation group leaders, such as Roland Clement of the National Audubon Society and Donald J. Zinn of the National Wildlife Federation, took part in a recent conference in New York sponsored by the Association for Voluntary Sterilization.

Next June, a 4-day "Congress on Optimum Population and the Environ-

POINT OF VIEW

Technological Abstinence Advocated

Murray Gell-Mann, winner of the 1969 Nobel prize in physics, speaking recently at a symposium sponsored by the John Muir Institute for Environmental Studies of San Francisco, called for a basic reorientation of science and technology. The following is excerpted from his talk.

We are all of us appalled at man's ravaging of his environment. The problem comes about as a product of three factors: population, the propensity for each individual to destroy the environment, and his capacity to do so through being armed with technology. All of these are increasing; all must be worked on in an effort to find some way to control the trend and ultimately make it level off or reverse.

It used to be true that most things that were technologically possible were done. . . . [C]ertainly, in the future, this cannot and must not be so. As our ability to do all kinds of things, and the scale of them, increase—for the scale is planetary for so many things today—we must try to realize a smaller and smaller fraction of all the things that we can do. Therefore, an essential element of engineering from now on must be the element of choice.

. . . In trying to change the trend, we all look forward in the near future to certain landmark actions. Landmarks of technological renunciation. For example, if no supersonic transports fly supersonically over land, that would be an example of something we can do and don't do for environmental reasons. If there are no SST's at all, that's possibly even better.

. . . [T]he major problem is to reorient the application of science and technology so that a major part of the application is in curing the problems that have arisen as a result of the applications so far.

ment" will be held in Chicago, with one of its major goals being to weld an alliance of population groups, conservation organizations, and other groups such as the American Association of University Women and the National Student Association. Some 1100 delegates from 250 organizations are to be invited, and about 100 scientists and other specialists on population, ecology, and conservation will participate.

The organizers of the congress include such people as Paul R. Ehrlich, professor of population biology at Stanford (and author of *The Population Bomb*, published by the Sierra Club and Ballantine Books), the Reverend Canon Don C. Shaw of the Episcopal Diocese of Chicago (and director of information and education for Planned Parenthood/World Population from 1961 to 1967), and Representative Richard D. Lamm, a member of the Colorado state legislature and a leader of the Colorado Institute on Population Problems (even Colorado, ranking eighth among the states in land area but only 33rd in population, is finding that its open spaces are neither so wide nor so uncluttered as they once were).

Canon Shaw, executive director of the congress, told *Science* that the hope is that after the Chicago meeting the delegates will encourage their organizations to mount action programs aimed at promoting and attaining the goal of the two-child family. Campaigns might, for example, be focused on such specific objectives as the establishment of state population commissions, the liberalization of state abortion laws, and the elimination of "pro-natalist" bias from federal and state laws and policies (the federal income tax law, for instance, places no limit on the number of children for which the taxpayer can claim exemptions).

The dimensions of the U.S. population problem were explored in September at a 2-day hearing held by the House Conservation and Natural Resources Subcommittee, chaired by Representative Henry S. Reuss (D–Wis.). A theme stressed by several of the witnesses, such as Jean Mayer, professor of nutrition and member of the Center for Population Studies at Harvard, was that the need to control population growth is no less urgent in the rich countries than in the poor countries. Mayer had developed that argument earlier in an article that appeared in *Columbia Forum* (summer 1969). In that article, he indicated that the environmental degradation that has accompanied population and economic growth in the rich nations is more of a problem to the world than the pressure put on food supplies by the poor nations' burgeoning populations. The food situation, he said, is not worsening and, in 20 or 30 years, with the application of the most advanced agricultural and food production methods, it may be removed altogether as a limiting factor

Yesterday Cyclamates, Today 2,4,5-T, Tomorrow DDT?

Action taken by two government agencies in recent weeks to protect the consumer from potentially harmful chemicals has encouraged some environmentalists to press for a ban on DDT.

On 18 October, only 5 days after learning that cyclamates cause cancer in mice, Health, Education, and Welfare Secretary Robert Finch ordered the sweetener off the market. A few days later, the White House announced that the Department of Agriculture was canceling the registration for use on food crops of the herbicide 2,4,5-T, which has been shown to cause birth defects in animals. The White House also announced that the Defense Department would restrict the use of the herbicide as a defoliant in Vietnam to areas that are remote from population.

Instead of offering it a pat on the back, however, a coalition of environmental activists in effect told the government: Having taken these actions, you simply must ban DDT, which [they said] is more pervasive in the environment and more harmful than either cyclamates or the herbicide. Four organizations—the Environmental Defense Fund, the Sierra Club, the National Audubon Society, and the West Michigan Environmental Action Council—made this argument in a petition last Friday, asking the Secretary of Agriculture to ban immediately the use of DDT. The action against cyclamates and the herbicide, the petition stated, "confirm the federal policy of banning cancer-producing agents by immediate action."

"Cancer-producing," in the case of cyclamates, 2,4,5-T, and DDT, means that very high concentrations of the chemical induce cancer in laboratory animals. The Congressional definition of danger, which appears in the Food Additives Amendment to the Food, Drug, and Cosmetics Act, is that no additive "shall be deemed to be safe if it is found to induce cancer when ingested by man or animal. . . ."

Attorneys for the four groups would not rule out the possibility of court action against the Department, if it fails to act. The Environmental Defense Fund in particular has often employed litigation as a weapon against polluters.

The decision to cancel the registration of 2,4,5-T, much less publicized than the cyclamate affair, was announced by Presidential Science Adviser Lee DuBridge only a few days before the DDT petition. It came as a result of yet unpublicized experiments conducted by the Bionetics Research Laboratories for the National Cancer Institute. The study, conducted primarily on mice, indicated that the herbicide caused an increase in the incidence of cancer and malformed fetuses.

The evidence against DDT, on the other hand, is not hot out of the lab. While it emphasizes a recent study supported by the National Cancer Institute, the petition cites many older studies showing carcinogenic effects of DDT on laboratory animals.

The petition to Secretary of Agriculture Clifford Hardin drew support from, among others, the United Auto Workers and former Secretary of the Interior Stewart Udall. At the press conference announcing the petition, Udall said the Nixon administration "hit a single" in the 2,4,5-T cancellation and a "double" in banning the use of cyclamates. "The best home run for the environment," Udall concluded, "would be to ban the use of DDT in this country."—JOEL R. KRAMER

to population (by no means all specialists who have studied the world population problem take so optimistic a view of the "green revolution," however). He said that "rich people occupy much more space, consume more of each natural resource, disturb the ecology more, and create more land, air, water, chemical, thermal, and radioactive pollution than poor people."

In 1966, the United States, with only 6 percent of the world's population, consumed 34 percent of the world's energy production, 29 percent of all steel production, and 17 percent of all the timber cut. And, as Mayer pointed out, using solid wastes as one example, the United States demonstrates strikingly how the superrich tend to be superpolluters. ". . . We spread 48 billion (rustproof) cans and 26 billion (nondegradable) bottles over our landscape every year," he said. "We produce 800 million pounds of trash a day, a great deal of which ends up in our fields, our parks, and our forests. Only one-third of the billion pounds of paper we use every year is reclaimed. Nine million cars, trucks, and buses are abandoned every year, and, while many of them are used as scrap, a large though undetermined number are left to disintegrate slowly in backyards, in fields and woods, and on the side of highways."

Another witness was Preston Cloud, a geologist at the University of California at Santa Barbara, who presented to the subcommittee the summary and recommendations from a forthcoming report by the National Academy of Sciences' Committee on Resources and Man (of which Cloud is chairman). The report recommends, among other things, "that efforts to limit population increase in the nation and in the world be intensified by whatever means are practicable, working toward a goal of zero rate of growth by the end of the century." The committee said that, indeed, "a human population less than the present one [of about 3.5 billion] would offer the best hope for comfortable living for our descendants, long duration for the species, and the preservation of environmental quality."

While observing that world food supplies might conceivably be increased by as much as ninefold, the committee said that shortages already exist or threaten for many things (mercury, tin, tungsten, and helium, for example) considered essential for industrial society—a warning especially relevant for the United States and other rich na-

NEWS IN BRIEF

● **NIXON ENDORSES OCEANOGRAPHY DECADE**: The recently announced Nixon Administration marine sciences program includes an endorsement of a proposal for an International Decade of Ocean Exploration beginning in 1970. Although the financial commitment may be small—in the order of $25 million—for the first year, Marine Science Council officials say this Administration has shown "solid support" of the decade and other marine science programs proposed by the Johnson Administration. Also recommended is a response to concern about landfill in harbors and estuaries, and thermal pollution through development of a policy on coastal areas and the Great Lakes. It also calls for the setting up of coastal laboratories to conduct ecological studies, pollution control, and land management projects. The federal government presently spends about $300 million yearly on marine sciences research and development.

● **FOUNDATION CURBS**: The Senate Finance Committee voted last week to limit tax exemption privileges for most foundations to 40 years as it completed work on the tax reform bill. Foundations affected by the 40-year limit would be private, nonoperating ones, such as Ford, Rockefeller, and Carnegie, which do not derive major income from public contributions or memberships. A House version of the tax bill sets no such limit. The House bill was more stringent, however, in placing restraints on foundation involvement in political activities. The House bill also proposed a 7½-percent annual tax on the net investment income of private foundations; the Senate unit suggested halving that amount. The bill must now go to the floor of the Senate, and then to a Senate-House conference.

● **STANFORD SALARIES**: The *Stanford Daily* at the Palo Alto campus has published hitherto confidential salaries of administrators and professors. Highest salaries, it revealed, go to professors in the medical school and in the physics and chemistry departments; lowest salaries go to professors in languages and classics; research professors are better paid than teaching professors. A university official said the information came from files stolen by demonstrators who occupied Encina Hall last May. The information was first published in a 31-page document which appeared anonymously.

● **DEEP-SEA DRILLING**: The National Science Foundation (NSF) has announced it will give an additional $22.2 million to the Deep Sea Drilling Project to operate three more years. The DSDP has made discoveries of both practical and theoretical consequence so far. It found salt domes buried in the Gulf of Mexico, beneath which are believed to be massive oil and gas deposits. And it has found evidence to support the theory of continental drift. The project has been extended to 30 June 1973.

● **EDUCATION VIA SATELLITE**: India and the United States have recently agreed to begin an educational experiment using powerful broadcasting satellites in stationary orbit above the equator, just south of the Indian subcontinent. In 1972 NASA will launch a satellite capable of broadcasting directly to schools and community centers in more than 5000 villages. A ground station in Ahmedabad, plus six mobile stations, will send video signals to the satellite for broadcasting.

● **DRAFT FACTS FOR GRADUATES**: The Scientific Manpower Commission has published an updated version of *Draft Facts for Graduates and Graduate Students 1969–70*. New features include a cross-index and forms for potential draftees who want help in getting military assignments which use their civilian training. Single copies are available for $1 ($75 per 100) from the Scientific Manpower Commission, 2101 Constitution Ave., NW, Washington, D.C. 20418.

● **BOUND FOR CHICAGO**: The American Physical Society (APS) will go through with plans to hold its national meeting early next year in Chicago after all. Several members approached the APS governing council last year, suggesting Chicago be boycotted as a protest against its actions during the Democratic convention; a subsequent poll of APS membership showed 57 percent favored Chicago anyway. At latest word, 450 members (3 percent of those who voted) have pledged to boycott the Chicago meeting.

tions now consuming such resources at a prodigious rate. The concept of an "optimum" level of population, which is implied in the recommendations of the Cloud committee, is an elusive one, however, for the optimum presumably would depend on the distribution as well as the size of the population and on a number of other variables, such as waste-control practices and the state of the technologies affecting the production and consumption of food and other resources.

Two Yale sociologists testifying before the Reuss subcommittee, Lincoln and Alice Day, said that if the present U.S. birth rate is to be reduced without resort to coercive restraints on family size (such as through economic sanctions or involuntary sterilization), much effort must be devoted to establishing social conditions conducive to the two-child family. For one thing, they said, the present "pervasive emphasis . . . on marriage as the only 'normal' adult status and on childbearing as a lifetime career for women" should be abandoned.

Also, in the Days' view, in order to give married women better opportunity for other satisfying activities besides childbearing, there should be more child-care facilities, more attractive part-time jobs, and public transportation facilities allowing easy, inexpensive movement between the home and centers of education and employment. The Days indicated, too, that a social system that allowed older people to lead more satisfying, independent, and dignified lives would mean that they would have less reason, when younger, to rear large families as a form of old-age social and economic security.

Preston Cloud also offered some provocative recommendations for reducing the birth rate. Among these were proposals that the Congress and the President exhort, by formal declaration, all American couples to have no more than two children; that tax and welfare laws be redrafted to discourage the bearing of children after the second; that legal restraints on homosexual unions between consenting adults be repealed; and that abortions be legalized for all women desiring them and be performed free for indigents.

One imagines with difficulty President Nixon's ever presenting such a birth control package in a fireside chat with the American people. Yet, the rapid change in attitude over the past decade, at the White House and in Congress, about birth control should give encouragement to Cloud and other advocates of strong remedies. As the birth control issue has now evolved, becoming increasingly a question of broad social concern, less and less is heard of considerations once regarded by many as paramount. For instance, on this issue, Pope Paul VI, whose encyclical "Of Human Life" was issued little more than a year ago, is already becoming, in the United States at least, the forgotten man.

Indeed, some advocates of birth control, such as Garrett Hardin, a biologist at the University of California at Santa Barbara, now speak boldly of eliminating "compulsory pregnancy"—that is, by allowing abortions on request. And it is true, in fact, that about one-fifth of the states have liberalized their abortion laws in the last few years, at least to the extent that no longer is an abortion allowed only in cases where continuing the pregnancy poses a threat to the woman's life. Furthermore, the California Supreme Court recently overturned the conviction of a physician who had referred an unmarried woman to an abortionist, partly on the grounds that a woman has a "fundamental right to choose whether to bear children."

Just how much concern the American public feels about mounting population pressures, on U.S. social institutions and on the environment, is a matter of conjecture. Judith Blake Davis, a demographer at the University of California at Berkeley and a witness before the Reuss subcommittee, says of the public at large that it is "still under the impression that children are glorious, and the more the merrier" and that the idea of a growing population producing a deteriorating environment is not one that generally figures in the calculus of the average American. The sudden interest within Congress and among the conservation groups in birth control suggests, however, that complacency is coming to be replaced with growing alarm.—LUTHER J. CARTER

Medical Schools: At the Center, the Problem Is Unreimbursed Costs

In July, President Nixon warned of a "massive crisis" in health care and said that "unless action is taken both administratively and legislatively in the next two or three years we will have a breakdown in our medical care system which will have consequences affecting millions of people throughout the country."

A chorus of alarm rising recently from the medical schools appears to confirm the President's diagnosis. Cuts in National Institutes of Health (NIH) in the support of biomedical research have hit the medical schools hard. And a wider public has begun to realize how important NIH grants have been in giving de facto support to medical education and patient care in teaching hospitals. But no matter how painful the reduction in research funds has been, the causes of distress in the medical schools are less simple and more serious than that.

Since World War II, the American medical school has become part of a large, complex institution, the academic medical center, in which medical education, research, and patient care are carried on interdependently. The crisis in medical care is often attributed to a shortage of doctors and a shortage of hospital beds. It can be better understood in terms of the growing deficits which most medical centers are running in all phases of their activities—education, research, and patient care (particularly patient care). And the deficits in most cases are far too large to be covered, as they often were in the old days, by a university stretching its budget or by a quick appeal to the community.

Hospital costs have soared in part, of course, because of the revolution in medical science and technology since World War II. Innovations such as intensive-care units for heart and burn