sistance of his devoted wife, Maria Louisa Maristany, whom he married in 1936. They have one child, a daughter, Francisca, now a student at Bryn Mawr.

To Francisco Duran-Reynals, life was an art and a high adventure. He felt disappointments keenly, but they could never, in the face of his unyielding purpose and conviction, lead to discouragement. To an extraordinary degree he was able, by contact, to transfer to others the intellectual vitality and enthusiasm which he possessed or—perhaps better—which possessed such a large part of him. He did this naturally and with complete simplicity.

Sensing inwardly the drama of the search for and discovery of new scientific knowledge, he reflected his own absorption and emotion in the presentation of the results of his research work. One had the overpowering feeling that, as a part of the audience, he was reliving the collection, tabulation, and interpretation of the experimental results. They entered the hearer's consciousness as living, meaningful units of scientific progress, not as dead and recorded facts.

The experience of presenting his results was so vivid and intense to Duran-Reynals that it was at times almost exhausting to this sensitive and completely consecrated man. He would fret and chafe at the unavoidable waiting and slow unfolding of a scientific program. One could see that his keen, alert mind was "champing at the bit" to be at the job of exposition and discussion.

There were many times when his handsome aquiline profile and proud searching eyes reminded one strongly of a poised hawk ready to wheel and strike, but only to *capture,* not to *kill.* For there were few if any destructive elements in his character. He was absorbed in the joy of the hunt—the finding of the unexpected—and not in tearing to pieces the work of others. He expected the good and the true.

Duran-Reynals had a great capacity for kindness, affection, and loyalty towards others. These qualities made a powerful and invulnerable framework for his life. In the years that I knew him he never aged or wavered in the spiritual integrity of his deep faith in mankind and in God. In fact, he had richened and ripened in that faith to a point that made one realize that he had atttained the rare inner peace that is built of unselfish action, devotion to work and to ideals, and unstinted giving of oneself.

His life proved that high standards of scientific research and complete humility of spirit can be symbiotic in the truest sense of that term. It proved also that their combination can give a fine and beautiful light which is a source of encouragement, inspiration, and thankfulness to others. The tragedy of Duran-Reynals' early death and of the suffering which preceded it are softened gently and beautifully by the ageless, simple qualities of human greatness of which his life was composed.

C. C. Little
Roscoe B. Jackson Memorial Laboratory, Bar Harbor, Maine

News of Science

Greater Role for U.N. Specialized Agencies Seen in Meeting Problem of Population Outrunning Resources

In recent years the United Nations has played an important part in studying, through demographic surveys, the unprecedented growth in world population. But now there is a growing feeling that the U.N. should assume an active role in promoting population control. Since the beginning of this century, the population has increased more rapidly than ever before in history, chiefly because of scientific advances that have led to progressively lower mortality rates, while birth rates have not declined. A few figures from a recent report, *The Future Growth of World Population,* published by the U.N. Bureau of Social Affairs, bring the situation into focus.

Population Growth

During the first half of the 19th century, world population reached 1 billion; in 1930 the figure was about 2 billion. In 1957 and 1958 alone, the earth's population increased by 90 million, a figure twice the population of France, and the world is expected to have 3 billion inhabitants by 1962.

The acceleration of population growth in underdeveloped countries is especially spectacular. Annual increases of 2 percent or more are usual in most of these countries, and in some there is a growth of 3 percent, a rate that the U.N. report describes as "probably outside the experience of any nation before the last ten-year period." In contrast, the population of the United States is growing at the rate of 1.7 percent per year.

Japan is the only country that has had a sharp drop in birth rate. Within the last decade its birth rate has been cut in half: from 34.3 per thousand in 1947 to 17.2 in 1957. (Three quarters of the reduction was caused by induced abortion, according to *News of Population and Birth Control* for December 1958, published by the International Planned Parenthood Federation).

Today, Latin America has the most rapid population growth of any major area. If the trend continues, by the end of the century it will have the second largest population, 593 million, among the world's major regions. Asia, with a projected 3.9 billion people, would remain in first place.

United Nations Action Impeded

The March issue of the Population Reference Bureau's *Population Bulletin,* which reviews world population, pays tribute to the invaluable work of the United Nations in the field of demography, but in a section headed "An Agonizing Appraisal," it points out that the U.N. has been "impeded in any realistic, curative attack on the population problem, because of a three-way split in thinking concerning policy formulation." The three factions are the Communist bloc, the Roman Catholic bloc, and the Western bloc.

According to observers, the Communist bloc maintains that to limit population is to limit the growth of the masses, the working people. The Communist group acknowledges the population problem but feels that with a changed economic and social order, living standards could be improved to meet the rapid population increase. An example of the Soviet stand was provided

on 13 March at a meeting in Australia of the U.N. Economic Commission for Asia and the Far East. During a 2-day debate on population the Soviet delegation was the only one to oppose limitation of the fast-growing Asian population. P. M. Chernyshev, deputy leader of the delegation, is reported to have said (*New York Times,* 15 March): "The key to progress does not lie in a limitation of population through artificial reduction of the birth rate, but in the speedy defeat of the economic backwardness of these countries."

It is interesting to note that Kerala, the only Communist state in India, has perhaps one of the most advanced birth-control programs in the country. An Indian spokesman reports that at first the Communist politicians opposed the Central Government's family-planning program, but when they came to power they reversed their stand because they found it impossible to deal with Kerala's economic difficulties without reducing the dense population—1017 people per square mile.

The U.N.'s Roman Catholic bloc concedes that rapid growth in over-populated regions is serious; however, it refuses to consider any corrective programs that might lead to the use of controls morally unacceptable to the church. The third group consists of the demographic representatives of the Western nations, who cannot accomplish very much without the cooperation of the first two groups.

The Population Reference Bureau article observes that the result of these differences has been a "tendency to talk in generalities, and to shy away from recommendations for coordination of United Nations efforts and for guidance to member nations in policy formation." The article ends by pointing out that the global efforts to reduce mortality cost approximately $30 million each year, while only a few million dollars are allocated to programs that affect birth rates.

U.N. Population Commission Meeting

A recent major event in population study, the biennial meeting of the United Nations Population Commission, provides encouragement about the future role of the U.N. At the close of a 2-week session in Geneva, the commission adopted unanimously a report that called attention to the "unprecedented increase" in world population. The 15-member body expressed concern not with the accelerating growth itself but with its social and economic consequences in underdeveloped countries. The commission urged that the United Nations shift the emphasis of its activities in the demographic field, saying: "While continuing to increase the technical coverage and quality of demographic information, it can devote more attention to aiding countries in the study of the interrelation of population growth, vital rates and population structure on the one hand, with economic and social development on the other."

Since the United Nations population efforts have so far been primarily devoted to collecting data, the recommendations approved by this conference indicate a distinctly hopeful trend. Robert C. Cooke, director of the Population Reference Bureau, commented that this formal recognition of the soaring population, combined with the suggestion that data be related to economic and social problems, could be described as a "notable milestone" in United Nations population activities.

The report of the Population Commission, a subsidiary body of the U.N. Economic and Social Council, will be presented to the council's 27th session, convening in Mexico City on 7 April.

Illiteracy Rates Cited

Last month some of the key factors in population study were outlined by William S. Vogt, director of the Planned Parenthood Federation of America, when he spoke in Washington on "Population Growth and Dwindling Resources." In analyzing the interrelationship of population and various economic and social factors, Vogt stressed the kinship of population and literacy rates. Without education, economic improvement is impossible. In Egypt the illiteracy rate dropped from 93 percent to 80 percent in a 40-year period, but the number of illiterates increased by 3 million. In Brazil the rate dropped from 65 percent to 51 percent between 1900 and 1950, but the number of illiterates increased by 9 million. And finally, in India the rate dropped from 94 percent to 80 percent, but the number of illiterates increased by 138 million.

Vogt then presented some figures from the point of view of our educational statistics at the primary-school level. Our annual population is increasing at the rate of 11 percent in the number of children in the primary grades. In Egypt the number is 33 percent; in El Salvador, 35 percent; in Mexico, 27 percent; and in Taiwan, even with the West's extensive aid, 29 percent.

Vogt emphasized that in all the underdeveloped areas there is great mismanagement of resources; soil erosion is acute. He commented that India, in particular, with its annual population increase of 6 to 7 million, is a challenge to science. India will double her population of some 370 million in 40 years, Pakistan in 35. In northwestern India the soil is so exhausted that it contains only 1 percent organic matter. Vogt mentioned the recent food riots and the United States wheat that is being sent to prevent famine.

Planned Parenthood Conference

Vogt devoted much of his talk to Southeast Asia, basing many of his remarks on two papers that he had heard at the International Conference on Planned Parenthood in New Delhi, India, 14–21 February. One of the papers was by Halvor Gille, a Dane who is social affairs officer for the Social Affairs Division of the U.N. Economic Commission for Asia and the Far East. Gille did not attend the Delhi meeting in an official capacity, however. When Vogt explained this, he mentioned the inadequacy of the United Nations program.

Gille's paper pointed out that although Southeast Asia covers only one-seventh of the total land area in the world, it has 53 percent of the world's population. He emphasized that the region has more than 25 million new mouths to feed every year, and that per-capita food consumption is 15 percent below the prewar level, despite all the scientific and agricultural efforts. He estimated that in mainland China alone, with 650 million people, the population is increasing by more than 1 million every month. Vogt said that another of Gille's interesting points was his observation that children under 15 years of age constitute about 40 percent of the population in the region, whereas they constitute only 25 percent in the West.

The second paper that Vogt described was "Population in an Atomic Age" by Homi J. Bhabha, chairman of the Indian Atomic Energy Commission. Bhabha has no faith that population can be reduced through clinical methods, certainly not those of the West. Pointing out that to improve living conditions in India an immediate 30-percent population reduction is necessary, Bhabha suggested that the only solution is an oral contraceptive that could be put into food—into rice or salt, perhaps. Further, he urged the creation of a "strong" central institute for research into the problem of controlling population on a national scale. Observing that Bhabha's paper had been most impressive, most forthright, Vogt said: "If we could get more Asian scientists such as Bhabha working on this problem, I'd be a lot more optimistic."

Sir Julian Huxley, eminent British scientist, also spoke at the conference on the subject of oral contraceptives, saying, according to the *Hindustan Times*:

"Efficient birth control methods are necessary to counterbalance the effect of efficient death control. Research for the development of a cheap and satisfactory oral contraceptive should be international."

On the final day of the New Delhi meeting, the role of the United Nations was again emphasized when the conference adopted a resolution which proposed that a family-planning program

be made an integral part of the activities of United Nations specialized agencies. The resolution made these recommendations: (i) the World Health Organization should provide contraceptive information as a part of its health program; (ii) the Food and Agriculture Organization should combine a family-limitation campaign with its efforts to increase food production; (iii) the Economic and Social Council should consider family planning as a "major means" of improving living standards; and (iv) the Human Rights Commission should include voluntary parenthood and freedom to obtain family-planning education in the listing of basic human rights.

Fallout of Strontium-90

On 23 March new information about fallout of radioactive material from nuclear tests was released in censored form by Senator Clinton P. Anderson (D-N.M.), chairman of the Joint Congressional Committee on Atomic Energy. The information appeared in part in letters by Maj. Gen. Herbert B. Loper (retired), special atomic energy assistant to the Secretary of Defense, and Willard F. Libby, commissioner, Atomic Energy Commission. Following are the texts of the letters.

Letter from Loper

Feb. 19, 1959

DEAR MR. CHAIRMAN:

The following is a brief status report outlining the present programs for analyzing and evaluating the radiation hazards resulting from atomic detonations.

Fallout reports from Operations Redwing (1956), Plumbbob (1957), and Hardtack (1958), are currently under preparation.

The hazards of local contamination from nuclear-weapon detonations have been fairly well delineated. However, the difficulty in accurately predicting the rapidly varying atmospheric conditions results in uncertainties as to the area of fallout. Predictions of local fallout contours from enemy bombs must be based on a large number of assumptions such as the type of weapon, height of burst, and yield. These unknowns do not allow accurate prediction of fallout from enemy bursts during wartime. Delineation of contaminated areas by airborne radiac instruments after deposition of the fallout is presently practicable and will be of considerable military and civil value during wartime.

The deposition of world-wide fallout or world-wide surface contamination is now beginning to be accurately measured . . . (Classified portion deleted) . . . Recent indications are that the radioactivity in the stratosphere has a residence half-life of two years (in contrast to the previously assumed value of about seven years) and the present amount of Sr^{90} in the stratosphere would be maintained by the injection of about 6 megatons of fission products per year. The concentration of the Sr^{90} on the surface of the earth is greater in the United States than in any other area of the world. The danger of carbon-14 and cesium-137 has been examined, and the immediate probability of any one individual being affected is about 1 in 500,000.

The risk of damage resulting from the testing of weapons is therefore extremely small and much less than other common occurrences such as x-rays, automobiles, chemical contaminants, household cleaners, etc. However, the probable casualties attributable to radioisotopes from weapon testing when summed over the populations of thousands of years create a moral issue that could be of considerable propaganda importance.

The distribution of the radioactive debris in the stratosphere as a result of the detonations to date is not clearly defined as to its altitude and latitude variation. The altitude dependence partially determines the drip-out rate and the latitude dependence influences the extent to which the world-wide fallout is uniform over the earth. Tentative conclusions to date indicate that three-tenths of the quantity of radioactive debris leaves the stratosphere each year, that the north-south diffusion of radioactive particles in the stratosphere does exist, and that in both hemispheres there is a latitude band of maximum drip-out which is from 35 degrees to 50 degrees north or south.

There is a need for more experimental and collecting programs in the following areas of the effects and behavior of fallout from nuclear weapons:

(a) Amount of fallout deposited locally from a low height of burst.

(b) More accurate determination of the drip-out rate of radioactive particles from the stratosphere.

(c) Further define the estimate of the amount of radioactivity formed per kt [kiloton] of fission yield.

(d) The refinement of measuring techniques to account for all radioactivity produced from a nuclear yield.

(e) Advancements in the knowledge of fireball chemistry, physics and particle behavior.

(f) Response of biological systems to radiation.

Sincerely yours,

(s) HERBERT B. LOPER

Assistant to the Secretary of Defense (Atomic Energy)

HON. CLINTON P. ANDERSON

Chairman, Joint Committee on Atomic Energy

Letter from Libby

Feb. 27, 1959

Hon. Herbert B. Loper, Chairman,
Military Liaison Committee.

DEAR GENERAL LOPER:

In connection with your letter to Senator Anderson of Feb. 19, 1959, concerning radiation hazards resulting from atomic detonations, I have just completed a study of data . . . which you kindly made available to us last December. I am sorry that, because of the complexity of the problem and my preoccupation with other duties, I have been so slow in finishing my consideration of the data and in sending on my comments. . . .

I think your letter to Senator Anderson is an excellent exposition of the present position we are in. There are, however, one or two points you make on which I believe further words are necessary in order to resolve some questions.

The extensive data that have already been published by Project Sunshine and the United Kingdom study group, together with your beautiful . . . work, still leave us, despite their great volume and complexity, in some uncertainty, as you say, as to the distribution of the radioactive debris in the stratosphere to both altitude and latitude variation, since the altitude variation determines in part the drip-out rate and thus the residence half-life in the stratosphere, this quantity is left in some doubt. My own present conclusion is in agreement with yours as stated in your letter, in that my previous value of seven years for this important number is too long and that it should be reduced. In a restudy of this question being released March 13 in Seattle, a copy of which will be sent you as soon as it is printed, a new value of about four years rather than the earlier seven is arrived at. I find it difficult to push it down to the two years you give as an indicative value.

On the amount of strontium-90 in the stratosphere, at the present time there is a somewhat larger difference in our estimates which may be due to your not having included the Russian series of last October, which in itself alone, according to my estimates, increased the stratospheric inventory by about 50 percent. . . . You give the present inventory as requiring 6 mt (megatons fission equivalent) per year to be maintained at its present level. For a half-life of two years this corresponds to only 17 mt total and appears to leave too little room for the injections from tests before last October, which I estimate still have left some 25 to 30 mt and a corresponding required rate of injection for steady maintenance of about 7 mt per year. The closeness of this figure to your 6 mt per year number shows how badly we need further information on the actual stratospheric content.