22. F. Osborn, *The Limits of the Earth* (Little, Brown, Boston, 1953).
23. W. Vogt, *Road to Survival* (Sloane, New York, 1948), pp. 16, 22.
24. *Statistical Yearbook* (United Nations, N.Y.)
25. PEP (Political and Economic Planning), *World Population and Resources* (Essential Books, Fair Lawn, N.J., 1955).
26. R. C. Cook, *Population Bull.* 13, 41 (1957).
27. K. Sax, *Standing Room Only* (Beacon, Boston, 1955).
28. S. B. Clough, *The Rise and Fall of Civilization* (Columbia Univ. Press, New York, ed. 2, 1957).
29. E. Ayers and C. A. Scarlott, *Energy Sources—The Wealth of the World* (McGraw-Hill, New York, 1952), p. 169.
30. J. C. Johnson, *U.S. Geol. Survey Profess. Paper No. 300* (1956), p. 13; M. K. Hubbert, *Proc. Am. Petrol. Inst. Drilling and Production Practice* (1956), p. 7.
31. H. Brown and L. Silver, *U.S. Geol. Survey Profess. Paper No. 300* (1956), p. 91.
32. H. Taylor and A. V. Tobolsky, *Am. Scientist* 46, 191 (1958).
33. C. G. Darwin [*The Next Million Years* (Doubleday, New York, 1953), pp. 16–24] recently set forth the view that the future can be predicted by applying the laws of probability to the human race, and by considering the race as a whole to be analogous to a gas that behaves in a predictable fashion even though each of its molecules may behave differently. The behavior of the gas depends on both internal and external conditions, and in Darwin's analogy the internal controls are human nature and the external controls are the resources of the earth. This thesis might well apply to a population of lower animals, but man's capacity to change his environment and to condition and control his nature and his numbers destroys the value of the analogy as a basis for forecasting the future of the human race.
34. M. K. Hubbert, *Smithsonian Inst. Publs. Rept.* (1950), p. 255.
35. R. C. Cook, *Human Fertility* (Sloane, New York, 1951).
36. P. K. Whelpton and C. V. Kiser, *Ann. Am. Acad. Political Social Sci.* 237, 122 (1945).
37. W. S. Thompson, *Population Problems* (McGraw-Hill, New York, ed. 4, 1953), p. 194.
38. A. M. Carr-Saunders, *World Population* (Clarendon, Oxford, England, 1936), p. 115.
39. U.S. Bureau of the Census, *Statistical Abstract of the United States* (Washington, D.C., 1957), p. 55.
40. H. Brown, J. Bonner, J. Weir, *The Next Hundred Years* (Viking, New York, 1957).
41. A. J. Toynbee, *A Study of History*, abridgment of vols. 1 to 6 by D. C. Somervell (Oxford Univ. Press, London, 1947).
42. R. C. Cook, *Bull. Atomic Scientists* 12, 295 (1956).

# Francisco Duran-Reynals, Bacteriologist

Francisco Duran-Reynals was born in Barcelona, Spain, on 5 December 1899. He died in New Haven, Connecticut, on 27 March 1958.

His early education, from elementary school through college, was in Barcelona. There too he took his M.D. degree in 1925. In the course of his medical study he was also assistant in the laboratory of bacteriology of the city of Barcelona. On his graduation he became a fellow of the "Junta para ampliación de Estudios." The first year of his fellowship, 1925–26, he spent at the Pasteur Institute in Paris. In 1926, still under the fellowship, he came to James B. Murphy's laboratory in the department of cancer research at the Rockefeller Institute in New York. In 1928, when his fellowship ended, he was appointed an assistant in that department, and in 1934, an associate.

In 1938, Duran-Reynals left the Rockefeller Institute to accept an appointment as research professor at Yale University School of Medicine, under the Jane Coffin Childs Memorial Fund for Medical Research. He was also appointed lecturer and research associate at Yale in 1952.

He was a member of the Academia de Medicina and of the Sociedad de Biologia of Barcelona and a corresponding member of the Institut d'Estudis Catalans and of the Sociedad de Biologia of Havana. He was also a member of the Harvey Society, the American Association for Cancer Research, and many other societies. He was for many years a scientific associate of the Jackson Memorial Laboratory in Bar Harbor, Maine, and spent many summers there. In 1957 he received the honorary degree of Doctor of Science from the Hahnemann Medical College of Philadelphia. He held medals from the Pasteur Institute and from universities of Liège, Brussels, and Montreal. In 1952 he received the Anna Fuller Memorial Prize for medical research. He was a consultant to the U.S. Public Health Service, the National Research Council, and the American Cancer Society.

During his stay at the Pasteur Institute, Duran-Reynals' work had dealt primarily with the lysis of certain bacteria, but soon after coming to the United States he began to take an active interest in viruses. This interest deepened and widened. At the same time the influence of testicular extract as a "spreading factor" was noted and was used fruitfully to study cell physiology (the ground substances of the mesenchyme). The two lines of research seized his imagination, and he held to both of them eagerly and vigorously.

His studies of the ground substances showed them to be a system of fundamental importance influencing the rate or success of infection, metabolic changes in cells, stability of crystalloids, intimate effects of hormones, allergy, and other phenomena.

Through investigation of a variety of known cancer viruses, notably avian, Duran-Reynals established a number of important facts concerning the nature and activity of those agents. Among these principles may be listed the following: (i) These agents can exert necrotizing effects on cells under certain conditions, notably in the young host. (ii) They can vary, adapting themselves to new hosts. When an "adaptation" occurs, a different type of cancer is induced. Thus, a single virus may be involved in the induction of many types of cancer. (iii) They have definite antigenic properties. (iv) They have their highest power of infection when injected in young hosts. (v) They have a definite epidemiological pattern.

From this work Duran-Reynals concluded that "cancer viruses" behaved fundamentally like other viruses and that possibly cancer could be considered to be of viral origin. For the sympathetic consideration of this hypothesis he was a willing and tireless crusader.

These conclusions led to the development of the second phase of his program in this field of research. This consisted in trying to discover whether ordinary viruses, especially those of the pox group, could, under certain conditions, induce cancer. Interesting and suggestive results were obtained, but the problem was unsolved and he was hard at work on it when his final illness set in.

He was an extremely versatile and imaginative investigator. His bibliography attests strikingly to this fact. Throughout his activity as a brilliant research worker he was strengthened and encouraged by the complete partnership and active as-

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