instead of whole-blood transfusions (about 70 percent of all transfusions are with whole blood). Implementation of these practices would reduce hepatitis risks and cut down on the waste of outdated whole blood.

It is beginning to look as though an all-volunteer blood donation system, like the metric system, is an idea whose time has come. Many countries are moving to emulate the exampe of Great Britain, which has always operated successfully with volunteer blood. Japan, for example, where tainted commercial blood was rampant, began a concerted drive to stamp out paid blood after American ambassador Edwin Reischauer came down with a widely publicized case of posttransfusion hepatitis.

Vigorous donor recruitment and public education programs appear to be the only answer to commercialism. Only 3 percent of the nation's eligible adult population of 100 million now gives blood, and a mere doubling of that number would solve the problem.

The matter of developing a coordinated system operating under uniform standards and handling blood at the lowest possible costs to recipients is more difficult. Change must come on top of a legacy of diffused responsibility, spotty information, and imperfect communications. The Administration is finally showing signs of reacting to the problem, but hasty reform is unlikely. Meanwhile, several thousand needless deaths continue to occur each year.—CONSTANCE HOLDEN

French Science Policy: Problems of "Leveling Off"

Paris. Four or five years ago a book by Jean-Jacques Servan-Schreiber, *Le Défi Americain*, helped convince the French that a technological gap yawned between the United States and the industrial countries of Western Europe. Now the French tend to yawn about the gap, although they still suspect the Americans of technological chauvinism, as a current furor over a navigation satellite demonstrates. But what seriously worries the French these days are the problems of "leveling off" in the science sector—the leveling off of research funds and of the demand for scientific manpower.

Leveling-off problems are familiar, of course, in the United States and Britain, for example, but they are more acute, or perhaps simply seem more sharply defined, in France because the general economy has been reasonably strong and because structural factors—notably the very direct reliance of the scientific community on government policy and funds—tend to accentuate the negative.

The ingredients, however, are international. A rapid buildup of research budgets took place during the de Gaulle decade, particularly during the middle 1960's. In the same period, the very rapid expansion of the university system provided more places for science students and jobs for those with graduate degrees in science. In France, the disturbances of May 1968 and the ensuing pressure on the franc and resignation of President de Gaulle brought changes in science policies and priorities. De Gaulle's mistrust of the Anglo-Saxons had caused him to follow a policy of independence, expressed in part through strong national programs in defense, atomic energy, space, and computers. Since 1969, expenditures in these areas have leveled off and in some sectors have been cut back. At the same time, the postwar demographic wave crested and the demand for teachers receded. French industry, which planners had looked to as an expanding market for R & D manpower in the 1970's, has shown a notable lack of passion for increasing its research establishment and in fact seems to have begun tightening its research budgets before the government did. The result of all this is that the proportion of R & D funds in the French gross national product has fallen from slightly over 2.4 percent in 1968 to slightly under 2.1 percent now. France's 6th Plan calls for a level of 2.45 percent to be achieved by 1975, but informed observers are not very sanguine about this happening under present circumstances. Add to all this the effects of inflation, and the similarities with the situation in the United States are obvious.

Under President Georges Pompidou, generally regarded as much more of a pragmatist than his predecessor, the French have been making some significant changes. In his statements on military matters, Pompidou now stresses the defense of French soil. With respect to basic research, the French are showing an increasing tendency to seek international arrangements, both within the European community and further East and West. And France's 6th Plan, covering 1970 to 1975, includes a variety of encouragements for industry-oriented research. Perhaps more significant, the government is demonstrating a tendency to cut its technological losses. The costly and, until now, uneconomic French program to develop natural uranium power reactors seems to have been shunted onto a side track, and the French national power company has contracted for two plants powered by American-type boiling water reactors and being built by a Westinghouse licensee. In addition, Westinghouse was reported in mid-March to have made a new proposal to set up a joint nuclear company in France on terms that presumably would meet past French objections. The French atomic energy agency (CEA) budget has flattened, and some of its activities have been cut back, resulting in some lost jobs and rising protests from scientists, engineers, and technicians caught in the squeeze. A proposal to detach CEA's computer division and, in effect, move it into the private sector is being discussed and sharply opposed by the unions. (Tensions arising in government laboratories and university science faculties over manpower problems will be discussed in a second article, which will deal with developments since the disruptions and reforms in the universities in 1968.)

The French are far from oblivious to the implications of research for their trade position in the enlarging Euro-

pean community and for their balance of payments situation as a whole. Like the United States, France wants to maintain and expand its exports in the high technology sector. As in the United States, it is being noted that relatively large expenditures on research and on science education have not conspicuously paid off. And there is the same musing about stimulating innovation, in the sense of fruitful and timely application of research results in industry.

Franco-American science relations provide an instructive study in contrasts. On the one hand, cooperation in the basic sciences has probably never been better, and the same might be said for cooperation on work of a more applied character, such as work on environmental and urban problems. But when it comes to applied research that may have industrial impact, it can be said that the ghost of the technology gap still walks.

Cooperative Spirit

Certainly, general science relations are infinitely better than they were in the middle 1960's, when the American refusal to sell France big computers that might be used for work on the French H-bomb (*Science*, 12 May 1967) seriously chilled the atmosphere. The new spirit of cooperation seems to date from a meeting between presidents Pompidou and Nixon after both had taken office. There followed an exchange of visits between Nixon's science adviser Lee A. DuBridge and France's Francis-Xavier Ortoli, who under Pompidou took over an upgraded portfolio as minister of scientific and industrial development. Agreement was reached on a number of projects of mutual interest, principally dealing with environmental problems and urban questions.

American officials describe the arrangement as very much to the advantage of both sides, with the French, for example, contributing useful experience with performance standards in building, and the Americans offering a lot of experience in modular construction gained by building mobile homes. American officials have also been interested in the progress and the problems of the planned city of Vaudreuil outside Paris (*Science*, 1 October 1971). American observers say that one factor which has given the program special vitality is that contacts have been made directly between scientists at the laboratory level and that projects are funded with regular lab funds on both sides. This ensures that the projects are attractive and competitive. For reasons that are not really clear, the U.S. government preferred not to conclude a formal scientific exchange agreement with France, as it has, for example, with Italy and Japan. This apparently irked the French somewhat, but the program seems to be working to mutual satisfaction.

A couple of examples of rougher sledding in scientific cooperation are worth noting because they drew much greater notice in the press and in government circles in France than in the United States. In both cases space satellites were involved, and the issue had a built-in sensitivity for Europeans because, among Western countries, the United States has a virtual monopoly in space. The more serious case involved "Aerosat," a proposed aviation navigation satellite system. The idea had been under negotiation for some time, with NASA and the European Space Research Organization (ESRO) doing the talking. Early in 1971, the U.S. government decided that it was really a commercial aviation affair and that airlines should share the costs. The matter was then transferred to the Federal Aviation Administration (FAA), a move that the Europeans disapproved of but seem to have gone along with. Then in February the White House rejected the plan worked out by the FAA and the Europeans, and the project seemed effectively scuttled. The Europeans see the decision as having been made in the White House Office of Telecommunications Policy, link it directly with the American balance of payments problems, and cast American industry, particularly COMSAT, as the villain of the piece. Instead of the joint space venture they hoped for, the Europeans have a situation that the Paris morning paper *Figaro* put in the form of a question in a headline: "Has American Industry Compromised Cooperation with Europe?" And now the Europeans are discussing ways and means of developing a system of their own.

The degree of sensitivity created was indicated by the reaction to a 1-day delay by NASA of an ESRO scientific satellite at Vandenberg Air Force Base. The French press reported that the ESRO rocket might actually be used to launch an American weather satellite instead, and this was interpreted as showing what American priorities really were. Much smaller news stories reported the launching of the ESRO satellite the next day.

For the French, the Aerosat incident seems to have crystallized the feeling that, in matters technological, the Americans will act from now on only when they have calculated the net gain or loss for the United States. The French are aware of the "Magruder exercise," and if they are wary of the sharpened U.S. concern about its balance of payments problems, they are also interested in American efforts at coupling research to innovation. In a period when the United States and France share common problems of leveling off, science relations between the two countries are likely to involve a new and volatile combination of cooperation and competition.

—JOHN WALSH

RECENT DEATHS

Glenn L. Alt, 76; former professor of civil engineering, University of Michigan; 17 December.

Charles E. Atkinson, 67; professor of education, Kent State University; 28 November.

George D. Beal, 84; retired director of research, Mellon Institute; 3 January.

Robert R. Bush, 51; former chairman, psychology department, Columbia University; 5 January.

Thomas J. Caruthers, 86; former director of education, Salisbury State College; 30 November.

I. Clyde Cornog, 78; associate professor emeritus of physics, University of Pennsylvania; 11 November.

Edmund W. Fenn, 66; former professor of political science, University of New Hampshire and Dartmouth College; 24 October.

Eduard G. Kreuzhage, 70; executive head, Verlag Chemie, Weinheim, Germany; 7 November.

Clarence C. Little, 83; founder and director emeritus, Roscoe B. Jackson Memorial Laboratory; 22 December.

H. Wallace Peters, 79; former provost, Cornell University; 27 December.

Charles W. Porter, 91; retired professor of chemistry, University of California; 21 October.

Kenneth P. White, 57; president Quincy Junior College; 27 November.

Philip E. Wilcox, 49; professor of biochemistry, University of Washington; 2 November.