ment maintains on-site housing for black workers at the station, but, according to Diggs, these accomodations are nothing more than "pillboxes," without plumbing or electricity. And while their children do attend two primary schools, the schools are 3 miles from home and no transportation is provided.

A NASA statement says that the CSIR is thinking about building an elementary school near the tracking station that would double as a community center for nonwhite workers and their families. NASA and the CSIR also say that they're looking into the possibility of giving financial aid of some kind to nonwhite children at the station who want to attend secondary school. The only ones in the vicinity open to the children are residential schools, and for most families these are prohibitively expensive.

None of this seems to represent a lifting of apartheid, however, and none of it seems to have pacified the congressmen nipping at NASA's heels. In full knowledge of the CSIR's concessions, Representative Charles Rangel, a Democrat from Harlem who sits on the House space committee, is pushing an amendment to the space authorization bill which—if adopted by the full Congress—would force NASA to close both its tracking station near Johannesburg and a smaller optical tracking station at Olifontsfontein.

Could further concessions be reasonably expected from the South Africans? NASA officials insist that anything as dramatic as the abolition of apartheid at the station is simply "unrealistic." They say that, in their very private talks with the South Africans, they are not only obliged to speak softly but, by their estimates, they wield a rather small stick. In the absence of any legal leverage, NASA's persuasiveness depends to a great extent on how hard Diggs, Rangel, and others press for reforms at the station and on how badly the South Africans want to keep it. There is some difference of opinion on the latter point.

Beneficial for South Africa

"This station is better known in the United States than it is there," one space agency official insists. "It's important to a small segment of the scientific community there but not to the community at large. Why, some people at CSIR hadn't even heard of it." However, other reports (*Science*, 10 July 1970), indicate that some South Africans feel that the station bestows a measure of international prestige on them, that it provides a valuable entrée to advanced technology, and that it serves as a useful training ground for engineers and technicians. (Neither of the two training programs run by the CSIR at the station is open to black employees, at least partly because the South African Job Reservation Act forbids nonwhites from working as electrical engineers.)

Predictably enough, Diggs, his colleagues, and staff show little tolerance for NASA's squeamishness. Mrs. Goler Butcher, a staff member of the Diggs subcommittee, says that neither NASA nor the station managers have yet demonstrated that black workers could not be given job training, promotions, higher wages—all within the restraints of apartheid. Nor, she says, is there any obvious legal obstacle to turning the operation of the station over to an American contractor like Bendix which would be subject to fair employment regulations.

"The South Africans are very practical people," Mrs. Butcher says. "When they want something they can make the necessary accommodations. . . . Once the people at NASA get it through their heads that we are going to keep pressing this issue, and once they relay that message to South Africa, I am convinced that things will all be worked out."

—ROBERT GILLETTE

Blood Banking: Money Is at Root of System's Evils

The past couple of years have witnessed growing concern about the efficiency and safety of blood banking practices in the United States. Critics deplore the commercialism that is woven into the business, competition and lack of coordination among various blood banking networks, sharp variations in the costs of blood and blood processing around the country, and the flimsiness of both state and federal regulatory activity.

The most visible part of the controversy centers on the fact that thousands of people die of hepatitis each year after being transfused with virus-tainted blood. This blood tends to come from certain kinds of paid donors—alcoholics, drug addicts, and prisoners—among whom surveys have found hepatitis to be 10 to 70 times more prevalent than in the rest of the population.

The best available statistics (and these are none too good) show that hepatitis in the blood of paid donors occurs in about 30 cases per 1000, as opposed to 3 cases per 1000 among volunteers. It is estimated that 1 in 150 patients receiving transfusions is inoculated with the disease, and of these, about 15 percent of persons over 40 years of age die from it. The Center for Disease Control in Atlanta estimates that hepatitis resulting from transfusions accounts for some 3500 deaths a year, but many doctors believe that, because of unreliable and inconsistent reporting, the total is closer to 35,000. The Australian antigen test developed a few years ago is now almost universally used, but this test detects hepatitis in only 25 percent of affected blood.

The reaction of many members of Congress and of the public is that the obvious solution is to move the nation onto a totally volunteer system of blood donation. A number of bills introduced in Congress have been aimed at easing commercial blood out of the national circulation, but a look at the blood practices in the nation today shows that this is no simple matter. Because blood banking has essentially grown up in private hands, with little or no central civilian or government guidance, there is little agreement even among the best intentioned and best informed over what steps should be taken. And since no consistent nationwide data exist on the economics of blood banking or the uses to which blood is put, various

blood bankers are free to select the data which best support their respective philosophies.

For a business which at first sight would seem to be dictated by a few simple exigencies, blood banking has been characterized by a remarkable diversity in philosophy and organization. The science and practice of blood collection, processing, and transfusion has only grown up in the last 30 years. Prior to World War II the nation relied on voluntary donations, collected at hospitals when the need arose. The nation's first civilian blood bank was established in 1937 at Cook County Hospital in Chicago. Needs for blood during the war stimulated research, and by 1943 an anticoagulant had been developed which permitted fresh blood to be stored for up to 21 days. Around the same time techniques for separating red blood cells from plasma were developed, thus opening up the field of component therapy.

The present blood banking complex began taking shape in the late 1940's with the advent of a national Red Cross blood program and the formation of the American Association of Blood Banks (AABB).

The Red Cross, which gets all its blood from volunteer donors, set up its nationwide civilian program in 1947 with an eye to becoming the national blood collection and distribution organization. It now has 59 regional centers in 42 states and collects about half of the national total of 7 to 8 million pints.

The AABB, a trade association, was set up partly to protect the interests of the hundreds of hospital blood banks then in existence from the incursions of the Red Cross. Its membership now includes some 1400 nonprofit institutions that rely on both paid and nonpaid donors and a few commerical or profit-making banks (although it no longer accepts commercial memberships), but it is dominated by the hospital banks.

The AABB also runs a National Clearinghouse Program, set up in its present form in 1955, which operates on a system of individual and group blood credits. Last year the clearinghouse pushed around about 0.5 million units of blood, either through transfer of credits or transfers of blood.

While the Red Cross and the AABB have attempted to cooperate with each other increasingly in recent years (the Red Cross participates in the clearinghouse), their relation has been marked by competition and mutual suspicion. While both organizations believe in voluntarism, the Red Cross operates on the belief that blood and blood products should have no monetary value attached to them. Thus it charges participating hospitals only the costs involved in processing—a word which covers salaries, overhead, blood typing, testing, cross-matching (matching donated blood with that of the recipient), and fractionation.

The AABB believes that the only way to encourage donations is to levy a replacement fee—usually around $25—over and above the processing fee. The money is returned if the blood recipient can round up donors to replace the units he has received. This is the most clear-cut area of disagreement, but the fact that the Red Cross deals only in collection, processing, and distribution, while the AABB (because of its hospital orientation) is concerned with transfusion and the maintaining of balanced supplies, means that their philosophical differences run deep.

Also peopling the blood landscape are an unknown number of commercial blood banks, which operate for profit and pay donors $5 to $10 a pint. These are the ones that have developed an unsavory reputation, although they probably collect less than 5 percent of the national blood supply and are not all in league with skid-row donors. Commercial blood banks appear to be somewhat on the decline, except in the plasmapharesis business which, as one blood banker puts it, "is the truly messy corner of the blood bank system."

Plasmapheresis is the process whereby whole blood is drawn from the donor (almost invariably a "professional"), the red cells are extracted and reinjected into the donor, and the plasma is retained. This procedure permits a donor to give blood as often as four times a week (whole-blood donors are required to put 8 weeks between visits), and a sizable number of people earn their living this way. Component therapy has rapidly become a big part of the blood business in the last decade, and now about 25 percent of the blood drawn annually is broken down into its components—red cells, white cells, platelets, and plasma. Drug firms further separate the plasma into such fractions as gamma globulin, fibrinogen (a clotting factor), cryoprecipitate (for treatment of hemophiliacs), plasma protein fraction, and serum albumin. Many drug firms run profitable plasmapheresis centers, and hepatitis virus is not impaired

NEWS & NOTES

● **TELESCOPE SITE FIXED:** The National Science Foundation has selected a 3000-acre desert site in New Mexico as the location for its $76-million Very Large Array (VLA) telescope, the world's most sensitive and accurate radio telescope. The VLA will comprise 27 dish-shaped telescopes, each 82 feet in diameter, which can be moved along a Y-shaped track with 13-mile-long prongs. The telescope, 50 miles west of Socorro, will be able to pick up signals from this and other galaxies and is expected to add to knowledge on the laws of gravity, physical processes in interstellar gases, and the origin and evolution of the universe. After a 7-year search, the site was chosen on the basis of its high altitude, southern location, flatness, and the absence of man-made interference from noise and vibration.

● **ENVIRONMENTAL SUMMER:** Some 1300 college students will conduct independent research on the problems of the environment this summer with the aid of $1.9 million in grants from the National Science Foundation. Among the projects afoot are a study on how to overcome misperceptions that occur in interracial communication, a look into architectural preservation policies in Chicago, and a study of the economic and sociological impact of the San Jacinto fault.

● **MAN AND TECHNOLOGY:** A group of European and American scientists have joined Alvin Toffler, author of *Future Shock*, to form an international society to assess the social, political, economic, and environmental effects of technology. The International Society for Technology Assessment will be headquartered at The Hague and will have offices in Washington, D.C. Its main activities will be the publication of *Technology Assessment*, a new periodical, and the arrangement of biennial international conferences, the first of which is to be held next March at The Hague.

● **ACADEMIC ISSUE:** No subject is too large for the academic mind or, for that matter, too piddling. Listed among the new publications of the National Academy of Sciences is a work entitled *Hydrodynamics of Micturition*, a contribution to knowledge that may be purchased for $28.50 from Charles C. Thomas of Springfield, Illinois.

by being separated from red blood cells. Moreover, a dose of an agent such as fibrinogen requires the pooling of fractions from hundreds of donors, so the risk of hepatitis is high, even when donors are volunteers. (Many people carry the virus around undetected.) Much plasma comes from questionable origins. Under the "short supply" clause in federal regulations, licensed fractionating manufacturers are allowed to obtain plasma from unlicensed collectors—one such firm does a thriving business with needy Haitians—and the government takes the word of the manufacturer that the plasma meets government standards.

Where does government regulation come into this tangled picture? State control of blood banking is little in evidence. Only 7 states license banks, 5 inspect them, and 21 actually have laws that protect blood banks and hospitals from any liability in the event that a patient is transfused with tainted blood. By defining blood as a service rather than a product, laws exempt blood from implied warranty.

On the federal level, the only regulation comes from the Division of Biologics Standards (DBS), which, in 1946, was charged with licensing and inspecting of all blood banks engaged in interstate transactions. While this covers 85 percent of the blood drawn annually in the country, observers tend to agree that DBS lacks both the manpower and the motivation to exercise its mandate effectively. Federal control is further dissipated by the fact that it is in the hands of three different agencies: The DBS is responsible, under its vaccine and serum standards, for ensuring the "safety, purity, and potency" of blood and blood products; the Food and Drug Administration oversees the quality of blood containers and other equipment; and the Center for Disease Control is responsible for the standards followed by laboratories in testing and processing interstate blood. The cautiousness (some say overcautiousness) of the DBS may be exemplified in a remark by assistant director Sam Gibson: "We have the obligation not to make regulations so strict that the blood supply dries up." As a result, even the cautious National Academy of Sciences has said that "regulatory activity with respect to blood and blood products has followed far behind the scientific discourse in the field, and the application of new knowledge in behalf of the broader public welfare has been considerably impeded."*

With all the competition, overlapping, inconsistency, inefficiency, and waste inherent in this blood collecting system,

* *An Evaluation of the Utilization of Human Blood Resources in the United States*, a booklet prepared in October 1970 by the National Academy of Sciences Committee on Component Therapy.

Briefing

Metric A Go-Go

Today, the United States remains the only industrialized nation in the world with no policy to convert to the metric system; we are holding out with the foot, the inch, and the yard, which is fabled to have been the distance between the English King Edgar's outstretched hand and his nose. Wiser heads in the Senate, however, are concerned about this and on 29 February and 1 March the Commerce Committee held hearings on various proposals that would remedy this situation.

All three proposals would do approximately the same thing: They would set up a mechanism to draw up on short order a 10-year plan for changeover by government, industry, and educational institutions. The major proposal is a bill, S2487, introduced by Senator Claiborne Pell (D–R.I.) which would direct the Secretary of Commerce to formulate a plan in 18 months for the changeover. A second section would provide financial assistance for the changeover in the form of inducements and loans. A second proposal would have the plan drawn up by a nine-member board which represents all sectors of the economy, and offers no financial assistance in the conversion. This is the bill of Representative Robert McClory (R.–Ill.) and is labeled HR-12555. The third measure—if that term may be used—is the Administration's recommendation, sent to the House of Representatives 3 weeks ago, which would have a 21-member board draw up a plan within a year. All proposals would make the metric system the major—but not exclusive—form of measurement in the United States.

Ever since the days of Thomas Jefferson, Congress has been presented with requests for a new national system of measurement—but its response can only be described as somnambulant. Indeed, consideration of such proposals has become a 200-year-long ritual that generally draws from the congressmen only polite yawns and nods of the head.

The chances that any of the current bills will pass Congress this session are hardly better than before. However, the cause of "go metric" has recently gained some fairly prominent champions in the House and Senate and in the Administration, such as former Secretary of Commerce Maurice Stans, who believed that metric conversion would improve U.S. trade posture. Some estimate that if converted to the metric system the balance of trade could be improved in our favor by as much as $600 million.

Another champion of the metric system, Lewis M. Branscomb, director of the National Bureau of Standards, noted in a recent speech that the United States exported in 1969 as much as $14 billion worth of "measurement-sensitive products, such as vacuum pumps, typewriters, and computers. "A slight drop in our exports of measurement sensitive products could mean the difference between a favorable and an unfavorable U.S. trade balance," he said.

Evidently, he and others feel that it is high time we started seeing farther in the measurement field than King Edgar's nose and, for that matter, our own.—D.S.

The Brawling Bent

Charles Darwin and Captain FitzRoy had some fierce disputes during the 5-year voyage of the *Beagle*, but at least they managed to avoid throttling each other. In the case of a modern-day *Beagle* run by the U.S. Navy, officers and researchers have had a less fortunate experience.

The ship in question is the USNS *Silas Bent*, an oceanographic research vessel currently operating in the central Pacific. A Navy Department spokesman

it becomes clear that the hepatitis problem—which many experts say can only really be solved by developing foolproof screening tests for donors—is only the tip of the iceberg.

What is needed, say most responsible blood bankers, are two things: uniform standards, inspection, and accounting procedures; and transition to an all-volunteer system.

The rationale for the latter has been summed up by English sociologist Richard Titmuss in a recent book, *The Gift Relationship* (now being published by Pantheon Books), which uses blood practices as an indicator of the role of altruism in modern society. "If blood is considered in theory, in law, and is treated in practice as a trading commodity then ultimately human hearts, kidneys, eyes, and other organs of the body may also come to be treated as commodities to be bought and sold in the marketplace."

Many people agree with Titmuss that any equation of blood with money should be eliminated—that no cost should be attached to the substance itself either between donor and collector or between distributor and user.

This view appears to be gaining some momentum, but one of the major obstacles is medical insurance. Insurance policies began reimbursing patients for the costs of blood itself, as well as of processing and transfusion, in the late 1940's, a practice which greatly stimulated the growth of commercialism because it removed incentive to replace blood with blood. Later, Medicare and Medicaid weighed in with the same practice.

One of the most startling results of the present uncoordinated system has been the inconsistency in costs. The Red Cross, which charges only processing fees, charges hospitals anywhere from $8 (in Washington, D.C.) to $20 (in San Jose, California) a pint. The cost of a unit of cryoprecipitate can vary from $2.50 to $17.50, depending on where and by whom it is produced. The cost of a unit of blood to a hospital patient can range from $10.50 (in Seattle, where all blood needs are filled by the King County Central Blood Bank) to over $100—which can cover the costs of processing, repeated cross-matching, replacement, and transfusion. The reason for these discrepancies have little to do with whether blood is bought from the donor. In fact, say most blood banking experts, it is actually cheaper to buy blood than to recruit a volunteer. Indeed, one reason commercial banks stay alive in the competitive world of blood banking is that they can often supply blood, in the type and quality required, when and where it's required, at a lower cost than that charged by banks which put heavy reliance on volunteers.

Blood bankers have so far shown an

Briefing

confirmed that investigators are still looking into the causes of friction between the *Bent*'s crew and scientists and technicians that culminated in a wild barroom brawl on Midway Island earlier this month.

According to one version of the story filtering back from Midway, the conflict reached the kindling point when the *Bent*'s civilian skipper, a former naval officer, took it upon himself to sail his ship approximately where he pleased and thereby strayed more than 100 miles from where the *Bent*'s researchers were supposed to be mapping bottom contours. Whatever the cause though, the friction led to what the Navy described as "an exchange of blows" between civilian crew members on the one side and civilian scientists and technicians on the other, at the Midway Island officers' club on 6 March. One source said about ten combatants were involved.

Nobody was arrested and no charges were preferred, but a few fiery souls were apparently held for awhile in preventive detention until tempers cooled. The Navy said no one was injured, but rumor has it that one scientist or technician sustained a large gash on his forehead.

In a terse response to inquiries, the Navy spokesman said differences aboard the ship had been resolved and that the ship had sailed "on schedule, with no rotation of crew or scientists and technicians." *Silas Bent* may be a tighter ship, but chances are it is not a happy ship.—R.G.

Edwards Bites Watchdog

The three coequal branches of government instituted by the founding fathers may not always live in harmony with each other but neither do they customarily pursue their differences to the point of litigation. Yet that is what the Food and Drug Administration (FDA) believes is being done to it by Congress's chief watchdog over FDA activities, the House subcommittee on intergovernmental relations chaired by Representative L. H. Fountain (D–N.C.).

In a letter to Fountain last month FDA commissioner Charles E. Edwards grumbled that the subcommittee had furnished the news media with certain internal FDA memoranda relating to the livestock feed chemical diethylstilbestrol (DES). By demanding FDA memos and making them public, Edwards complained, "the subcommittee staff is in effect participating in litigation against the FDA, disrupting the FDA decision-making process, violating the intent of the Freedom of Information Act, and undermining the effectiveness of the agency."

The litigation referred to by Edwards is a suit entered by the Environmental Defense Fund requiring the FDA to ban DES. In a letter of 10 March replying to Edwards' recriminations, Fountain remarked that the memoranda in question were part of the record of a subcommittee inquiry that was under way before the suit was brought against the FDA. The inquiry, Fountain told Edwards, "cannot be curtailed because you believe FDA may be embarrassed or adversely affected in the conduct of its defense in the pending suit."

The FDA memoranda at issue are authored by scientists in the Bureau of Drugs and Bureau of Veterinary Medicine and take positions at variance with several official FDA statements on DES.

"I am disappointed that you have seen fit to oppose making public the differences of competent scientific opinion within FDA on this important matter," Fountain rebuked the Commissioner. "It would seem to me that in the interest of justice, as well as the public's protection, you have an obligation to reveal all of the relevant scientific evidence in the FDA's possession, not just those selective documents which you regard as supportive of your position."—N.W.

inability to get together and bring a measure of cooperation and uniformity into the business. One example of this failure is the demise in 1962 of the Joint Blood Council, which was set up in 1955 for the purpose of coordinating the goals and activities of the Red Cross, the AABB, the American Hospital Association, the American Medical Association, and the American Society of Clinical Pathologists.

Nonetheless, many observers believe that things are improving on the blood banking scene. For example, a court in Billings, Montana, recently set a precedent by holding Blood Services of Arizona, the country's largest nonprofit community blood banking network, negligent for having supplied a unit of blood (from a paid donor) to a patient who later came down with hepatitis. In California, Blue Shield has decided to reimburse patients only for blood processing and transfusion costs. The 10-year-old council of Community Blood Centers, a group of AABB members who were originally regarded as a mercenary lot, recently came out with a statement calling for the encouragement of volunteer donors, and the elimination of blood credits and replacement fees. The Red Cross, in its first comprehensive statement on national blood policy, on 22 February put itself on record as being for nationwide voluntarism and uniform medical, technical, and administrative standards.

Despite these encouraging signs, it is unlikely that the blood banking complex will be able to significantly increase coordination and efficiency without a prod from the federal government. A second article will discuss new initiatives in Congress and the executive branch, and what people in the blood business think should happen next.

—CONSTANCE HOLDEN

RESEARCH NEWS

Cell Membranes: A New Look at How They Work

Numerous biochemical events take place on or in the plasma membrane of a cell. Once presumed to be a relatively static entity whose principal role was the simple delineation of cellular boundaries, the plasma membrane has proved to be a dynamic and functionally complex structure that performs a wide range of physiologic tasks. Central to virtually all biological processes, the plasma membrane commands the attention of scores of investigators who are impressed and encouraged by the gains made in membrane analysis during the last decade. Nevertheless, there is no generally accepted explanation of biological membrane structure that provides a fundamental understanding of how membranes carry out their diverse functions. Membranes may be to the 1970's and 1980's what nucleic acids were to the 1950's and 1960's.

The apparent current enthusiasm for membrane studies is the outcome of work that has taken place within the last few years during which investigators have made use of innovations in instrumentation and technique to resolve at least one debate that has dominated membrane research for half a century and to raise new questions that might yield to sophisticated probes. The debate that has been settled involves the issue of the structure of lipids within membranes. The new questions concern membrane proteins.

Today, the picture of membranes that is emerging is one of a dynamic structure approximately 80 angstroms thick with a lipid core. Its surface may be a mosaic of patches of lipid, areas of protein, and carbohydrate sites where the sugar end of a glycoprotein sits on the outer membrane. (As far as is known, the carbohydrates in membranes occur only as glycoproteins or glycolipids and never as free molecules.) At points, proteins and glycoproteins penetrate the lipid core. A variety of techniques, including electron spin resonance, x-ray diffraction, immunofluorescence, and photodichroism suggest that within, things are fluid. Says Daniel Branton of the University of California at Berkeley, "We're beginning to imagine a sea of lipid in which other molecules swim. We're recognizing a great mobility of membrane components undergoing continuing reorganization." This is quite unlike the more subdued picture of membranes that used to prevail.

The classic model of membrane structure is of a lipid bilayer or biomolecular leaflet, the Danielli-Davson model proposed in the early 1930's. According to this model, the backbone of the membrane is formed of lipids with hydrophobic tails apposing each other within the bilayer and with hydrophilic polar heads pointing outward. Globular proteins were postulated to cover the lipids in layers, thereby making the membrane a protein-lipid sandwich. While generally accepted as correct, the lipid bilayer model had its limitations, the most serious being, in the opinion of many investigators, its failure to account for the striking functional diversity of various types of membranes; hence, model building continued, and new models were proposed and debated as experimental evidence accumulated. Models were presented that offered twists of one kind or another (one reversed the protein-lipid-protein assembly of the Danielli design and suggested that lipids formed the outer layers) and, in 1957, the unit membrane hypothesis captured widespread attention and support.

The unit membrane, as proposed by J. David Robertson of Duke University, retained the biomolecular leaflet of the Danielli model but stated that the protein existed not in globular configurations, either as alpha helices or random coils, but as slightly flattened molecules spread across the lipid bilayer in uninterrupted sheets. Further, it was held that the unit membrane structure was characteristic of all types of membranes, including those of intracellular organelles, as well as of cell surfaces. Experimental evidence for this concept rested heavily on data obtained from electron microscopy and x-ray diffraction of myelin.

Viewed under the electron microscope, myelin exhibits a characteristic railroad-track image, two major dense lines with lighter intraperiod lines interpreted as protein covering a continuous lipid core. X-ray diffraction patterns added to the picture. A mathematical synthesis of the patterns made by x-rays that were diffracted off a specimen of