explained. "You just find the right people to bring about the change."

Staff members who are still with ETIP told *Science* that, while they do not necessarily agree with everything Barnett said, there is much substance to his allegations, particularly those about management deficiencies and misrepresentations about what the program is accomplishing. But they contend that the internal difficulties have eased perceptibly in the past 3 months or so, and that the program does appear on the road to at least modest achievements. The program's most fervent backers believe the "hard sell" is both necessary and desirable—without it, they suspect, ETIP's impact would be negligible.

Though ETIP's official program plan was approved only 19 months ago, the program has already managed to win praise from some of the agencies it is assisting. Officials at those agencies seem pleased to have an outside group come in, help them institute changes that might otherwise be blocked by bureacratic rigidity, and pay a substantial chunk of the cost of experimenting with desirable changes. The typical mode of operation is that the ETIP staff will work closely with the agency's staff in designing an experiment acceptable to both, and ETIP will pay the "extraordinary costs" incurred by the agency to conduct the experiment.

One area of emphasis is government procurement policy, where ETIP has been working out experiments with the General Services Administration (GSA), the Veterans Administration, and state and local governments. The experiments seek to determine whether the government can stimulate technological change through its purchasing power by providing a market that would lessen the risks of introducing new products. Approaches under investigation include, among others, the use of performance specifications, which describe what a product should do without describing how it is to be made, thus giving manufacturers increased opportunity to innovate; life-cycle costing, which considers the total cost of operating and maintaining a product rather than simply its purchase price, thereby encouraging innovation in such areas as the conservation of energy that will be needed to operate a product; and value incentive clauses, which offer rewards to contractors who introduce cost-saving innovations in their products.

The experiments are too young to have actually resulted in the development of a new technology. But one experiment, in which GSA used life-cycle costing to buy 27,000 room air conditioners, resulted in the government obtaining units that require 21 percent less energy than the units purchased the previous year. A similar experiment in using life-cycle costing to buy 8000 water heaters led to energy savings and allowed a manufacturer to introduce technology into this country that he had previously been able to market only abroad.

Officials at GSA's Federal Supply Service told *Science* that ETIP has been "very useful" in helping them institute procurement changes that had long been discussed but never implemented. "Had it not been for ETIP, we would not be where we are now," said one key official.

Another focus of ETIP is government regulatory policy, an area in which ETIP has joint projects with some half-dozen federal agencies. An experiment conducted with the Nuclear Regulatory Commission, for example, sought to determine whether the time needed to devise standards could be cut by such simple devices as providing staff support to the panels of expert volunteers who formulate standards, and giving them the opportunity to meet for a solid week of work instead of the traditional 1- or 2-day sessions scattered throughout the year. ETIP claims to have cut standards development time from a year or longer to about a month, a speed-up that would reduce the uncertainty about standards that often inhibits innovation. An official of the commission reports that the new approaches could well affect the way standards are written in the future.

ETIP also has experiments aimed at more direct stimulation of civilian R & D and at assisting small business.

Much of the program is not directly related to technology—it is simply good management aimed at improving the environment for technological change. As Harris puts it: "I know its something good, but what the hell is it? It's really management dealing with technical subjects."

ETIP is still much too young to permit judgment of its impact. But if the program enjoys even a fraction of the success its supporters predict, it may well prove a major bargain.—PHILIP M. BOFFEY

Philip M. Boffey has rejoined the News and Comment staff. Boffey worked for *Science* from 1967 to 1971 when he resigned to conduct a study of the National Academy of Sciences which was published this year under the title *The Brain Bank of America.*

Medicine Without Frills: A Rural Hospital in Colombia

Apartadó, Colombia. In a remote area near Colombia's Atlantic coast, in a town whose very name means "far, far away," stands the Regional Hospital of Apartadó. Built in 1969 with government, university, and United Fruit Company funds, it is one of the best rural hospitals in Colombia. Yet its only x-ray machine has been broken for 2 years; it lacks hot water; and there is no laboratory equipment for elementary bacteriology and most blood chemistry.

Five years ago, Harvard Medical School began sending one student to the hospital for a clinical rotation every 2 or 3 months. As the student this past July and August, I carried with me a large suitcase of medical equipment and paid a stiff fee for room and board. In exchange, I experienced two of the most exciting and educational months of my time in medical school.

This fertile agricultural region was jungle and malaria-infested swamps until the United Fruit Company developed the banana industry in the 1960's. Although Apartadó did not even become a municipality until 1968, it is now a booming town of 28,000.

Reminiscent of our Old West, there are hundreds of prostitutes, machete fights in the saloons, and Leftist guerillas who swoop down from the hills to attack government targets. One Colombian doctor serving the required postgraduate rural year became nervous enough to acquire a pistol.

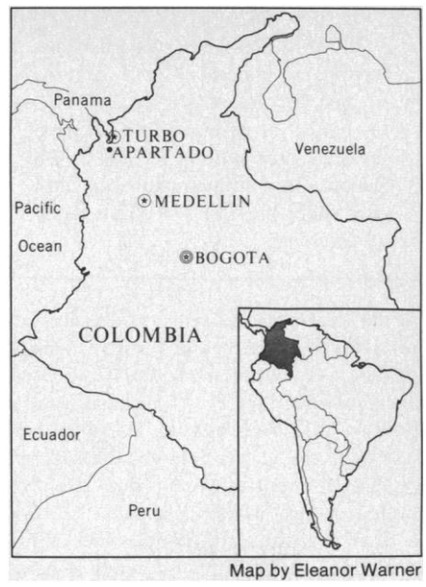
In 1969, the 28-bed hospital was inaugurated with an operating room, a modest laboratory, and academic affiliations with the medical school in Medellín, 200

miles south, and with Harvard University. The hospital's resources attract the top Colombian medical school graduates, who get first choice over their classmates of where they serve their rural year. These doctors have mastered a wide range of skills. In one afternoon I saw a physician perform a breech delivery, insert a chest tube to expand the collapsed lung of a hit-and-run victim, and do a medicolegal autopsy.

The hospital beds are often filled up. As a result, I treated as an outpatient a baby with severe gonorrheal conjunctivitis—a disease that would normally require immediate hospitalization. Ironically, a new building that would double the number of hospital beds was completed a year ago and stands empty for lack of funds. For most of the summer, the medical staff was only at half strength, with three doctors (two of them doing their rural year), a Colombian student in his last year of medical school, and myself.

The government oversees the hospital but provides only one-quarter of its income. The hospital must rely on its patients for most financial support and for this reason runs at a deficit. Because some drug companies with unpaid bills no longer do business with the hospital, the pharmacy often lacks penicillin for intravenous use and several other crucial drugs for months at a time.

Sometimes the water stops running completely. This paralyzes the hospital laundry and quickly brings to an end the short supply of clean linen. Every 2 or 3 days, the town's electricity fails for many hours. The power failure forces the laboratory to shut down and the operating room to switch to flashlight.



Map by Eleanor Warner

The lack of hospital resources leads to some interesting modifications in traditional hospital administration. When the electrocardiograph limb straps broke, instead of ordering the needed parts by catalog number, we went to the local bicycle store. There we purchased a flat tire, cut out rubber strips, and attached them to the machine—with perfectly acceptable results.

With only two registered nurses, the nursing staff is filled by "auxiliaries" who have a 9th-grade education and 3 years of training, and by "helpers" who have a 9th-grade education and only on-the-job training. Along with their regular nursing duties, they are delegated several tasks that are usually performed by physicians, such as giving intravenous drugs directly and inserting nasogastric tubes.

La vacunadora *administers vaccinations once a month in the isolated village of Aguas Frîas (Cold Waters). The hospital car has to drop her off several miles from the village and she must cross three shallow rivers, sometimes by foot and sometimes by mule, to reach her destination.*

This past summer, the hospital had the only functioning anesthesia machine in the whole of Urabá province, a region of 182,000 people. Therefore, we automatically became a regional referral hospital for difficult surgical cases. There is a remarkable amount of violence in the area, and the rate of trauma surgery is high. The commonest reason for opening the belly is penetrating knife wounds to the abdomen inflicted on prostitutes by their co-workers. One week we had five patients all recovering successfully from abdominal trauma surgery, three of whom were prostitutes.

Surprisingly, there is a low rate of postoperative infections, although there is no hot water for preoperative scrubbing. This can probably be attributed to fewer resistant bacteria than are found in large city hospitals.

Shipments of contraband from Panama have led to the development of organized crime in Turbo, just north of Apartadó. Gravely wounded victims of Mafia-type shootings provide another set of patients who need surgery. One case was that of an 8-year-old girl who answered a knock on the door. The visitor greeted the family by aiming his rifle at the girl's father. He killed the father instantly and shot the girl in the chest. She was rushed to the hospital, where a chest tube was inserted and her stomach was opened to assess the damage. She recovered uneventfully but returned to the hospital 2 months later with intestinal obstruction which had developed from the scar tissue of the first operation. The girl had severe peritonitis and septic shock. The only hope was surgery and, at the end of the second skillfully done operation, she died of a cardiac arrest.

Leftist guerilla attacks provide a third source of surgical cases. A private plane was hired last month to transport secretly 2 million Colombian pesos from the city of Medellín to an Apartadó bank. The plane landed at a private airport and was besieged immediately by grenades and machine-gun fire. The pilot and a customs official were killed instantly. A police sergeant assigned to guard the money was shot in the chest and abdomen. I gave the anesthesia for his 7-hour operation which involved opening his stomach and chest. We found holes in the diaphragm, stomach, jejunum, and colon. The patient survived the arduous surgery but died 12 hours later.

In previous years, the hospital had its own generator for electric power and did not depend on the town's power. Unfortunately, the crankshaft of the hospital's outmoded generator plant broke and new parts were no longer being made.

An American living near Apartadó was rumored to have two spare crankshafts

which fit the hospital's generator system.

The acting hospital director and I decided to visit him in pursuit of the crankshaft. He confirmed that he had the crankshafts but proceeded to accuse us of being lazy, of not knowing how to work the anesthesia machine which the United Fruit Company had donated, and of delivering poor patient care.

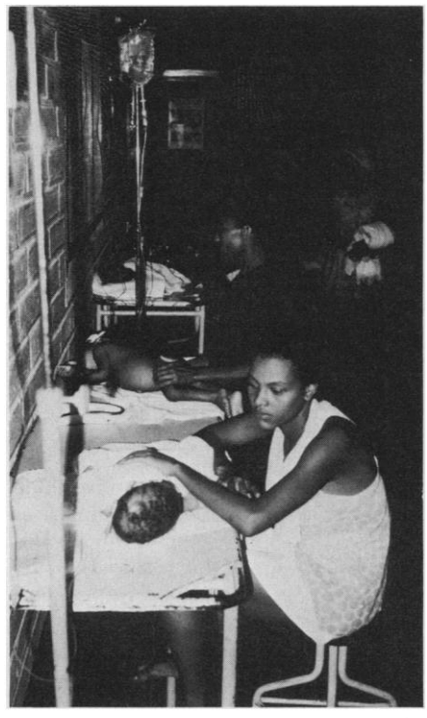
A few days later, Guillermo Herrera, the director of my Harvard program, came to visit the hospital. We decided to approach the American once again. When we visited him he was talking to a friend who had cut her finger the night before. We treated and rebandaged the woman's finger. When we got up to leave, he promised us the crankshaft and said he would deliver it within 2 days. One month later, when I left Apartadó, it had not arrived. The owner may well have had his reasons, but he kept them to himself.

Many of the medical cases serve as daily reminders that preventive medicine has failed. In July, the beginning of the rainy season, the incidence of new malaria cases more than doubled and we treated 239 patients. Nevertheless, the "eradication program" continues to meet resistance from rural residents who object to fumigation. And because the Colombian Army, for whom we provided all physician services, would only sporadically supply its soldiers with prophylactic antimalarial pills, some soldiers would inevitably contract severe cases of malaria.

Amoebic dysentery is another common illness. Amoebas in the polluted water invade the intestine and the liver, causing severe abdominal pain and explosive, bloody diarrhea. Carlos Jaramillo—who stayed on until this summer as Apartadó's hospital director for 2 years after his rural service year—charges that plantation owners in the area refuse to pay for the provision of clean water and construction of latrines, even though it would save them money in the long run.

Gastroenteritis causes more pediatric deaths in Apartadó than any other illness. Many babies in this region are made particularly susceptible because of malnutrition and the anemia caused by intestinal parasites. During the summer an epidemic of gastroenteritis occurred which forced us to assign more than half the hospital beds to pediatric care. Even this was not enough on several days, when mothers had to stay with their newly hospitalized babies in the corridor.

We encountered incidents that had not been part of my previous medical experience. In July, for example, we treated eight poisonous snakebites. Another unusual experience for me occurred when a child's condition did not improve and the parents



An epidemic of gastroenteritis overloaded the hospital last month and mothers had to stay with their babies in the corridor outside the emergency ward for several days until beds became available.

insisted that we discharge the child so they could apply grasses and herbs at home.

Preventable diseases that we rarely see in the United States continue to occur in Apartadó. Last winter there was a polio epidemic, and this summer two babies and one adult died of tetanus. That these diseases still take lives underscores the inadequacy of the vaccination program. There is a single "vaccination lady" (*la vacunadora*) and she gives about 1000 vaccinations monthly, only a fraction of what is needed.

The lack of preventive medicine efforts in the community is reflected inside the hospital, too. For example, although a screen door was installed this summer to keep flies and mosquitoes out of the pediatric ward, there was often no soap available so that we could wash our hands between patients. And despite government recommendations that newborns be vaccinated against tuberculosis, this is not part of the care that they receive.

The blood bank operates with almost no advanced planning. When patients need blood, their relatives are asked to donate and a plea is aired over the Apartadó radio. One night, a rural year physician and I were called from our rooms because a young man was said to be dying. Several days before, a tree had crushed his leg. His foot became gangrenous and he needed an amputation below the knee. During the days before the operation, while we tried antibiotics as an alternative to surgery, no effort was made to solicit blood from his relatives. That night, after his surgery, we found him with a heartbeat but with no blood pressure. He was extremely pale and needed a transfusion immediately. We found no blood in the blood bank and no available donor. Because my blood type (O-positive) was compatible, I gave a unit of blood. The patient eventually recovered, but no system was set up to improve the haphazard collection of blood.

Hospital employees were not given any special precautionary care. I know of no hospital employee who had all the recommended vaccinations. And in fact, four people working in the hospital got malaria in 1 week. Three of the four were taking no antimalarial pills and the fourth was on a regimen which had proven ineffective for her in the past.

One afternoon, three families of United Fruit Company executives came to the hospital. They had procured a vial of yellow fever vaccine and asked me to prepare and administer it. The vaccine is live and loses its potency after several hours. After I vaccinated them they gave me the remainder of the vial, which had about 40 doses left—enough to protect all the hospital employees on duty. To me this seemed especially fortunate because a yellow fever epidemic was being brought under control in another part of Colombia. Most of the hospital staff were unaware of the epidemic. More surprising was the resistance and fear of being vaccinated. Two nurses adamantly refused.

"We, the doctors, know preventive medicine is very important," said Jorge Henao, acting hospital director during August. "But we don't have time to do preventive medicine. It's sad, but it's the reality. The biggest problem is the economic problem. We don't have enough money to support all the necessities. We need beds, money, more doctors, more nurses, more equipment, and very good administrators. We need more government help."

I came back from 2 months in Apartadó with appreciation for the overwhelming odds and tough conditions which these rural doctors must face. They do an excellent job treating acutely ill patients. Graduates from the Medellín medical school are as competent as our second-year residents, not just in one specialty but in everything.

Their practical training is much more extensive and thorough than ours, and they taught me patiently. In their medical school, there are far fewer doctors per patient, none of the malpractice threats with which our schools must seriously concern themselves, and students have almost one extra year of time to study because of student strikes.

The key to improving health in Apartadó lies with basic public health measures—clean water, a sewerage system, a more stable social order, a more complete vaccination program, and better malaria control. Ironically, the availability of drugs seems to have fostered apathy about basic preventive measures, such as draining swamps, observing careful personal hy-

Briefing

Claim to Spanish Treasure Ship Disputed

The Department of the Interior last week filed suit disputing the finder's claim to the wreck of the *Nuestra Senora de la Atocha*, probably one of the richest Spanish treasure ships to have gone down off the coast of Florida.

The government hopes that the action will constitute a test case enabling all shipwreck sites outside the 3-mile limit to be brought under the jurisdiction of the Antiquities Act. This would ban private salvors and allow the wrecks to be recovered only by universities and those interested in the archeological value alone.

The *Atocha* lies 11 miles off the Marquesas islands at the western end of the Florida Keys. The site was claimed by the state of Florida until March of this year, when the U.S. Supreme Court, in a suit brought by oil companies, cut the state's claims back to the 3-mile limit.

The finder of the shipwreck, Melvin A. Fisher, then filed suit to establish his claim in federal law. It is this claim the Department of the Interior disputes.

The department's aim of protecting the nation's archeological heritage is doubtless admirable in intent. In this particular case, however, it happens that Fisher has spent 7 years and invested more than $700,000 in searching for the *Atocha* (*Science*, 8 November 1974). He has on his payroll a professional archeologist, Duncan Mathewson, who is satisfied that most archeological information is being saved, certainly as much as can reasonably be expected in a commercial operation. This July a salvage ship sank near the site, drowning a diver and Fisher's son and daughter-in-law. The government's move to claim the wreck comes at a time when the main treasure deposit seems finally to have come within Fisher's reach.

Asked if it didn't seem unfair to snatch the wreck from Fisher and his team so late in the game, an Interior Department attorney said, "I guess perhaps it does—that is why we have not kicked him right off the site, which we feel we have the authority to do."

The government, however, has not yet decided on what legal basis to challenge Fisher's claims. The Justice Department attorney who is handling the case for Interior says it is not certain whether he will cite the Antiquities Act—"We have to hustle around and see if we can find enough law to get our guys in." Fisher's attorneys argue that the Antiquities Act does not cover waters beyond the 3-mile limit, and that the international law governing nations' rights in their outer continental shelf was explicitly held by its framers to exclude shipwrecks.

At stake is a treasure of fabulous proportions. The *Atocha*'s manifest, completed in Havana a few days before she sank on 5 September 1622, lists 40.7 troy tons of gold and silver objects. The Spaniards failed to recover any of the ship's cargo, if the reports of their several salvage expeditions are to be believed.—N.W.

Science Adviser Bill Moves Forward in Congress

Congress has considered a plethora of proposals for reorganizing science in government, especially in the White House, ever since former President Richard Nixon banished the science adviser and his staff from that coveted location in 1973. Previous bills have stood, at best, an outside chance of ever becoming law; but Congress now seems ready to pass a bill in the next month which the President will be only too happy to sign.

The House Committee on Science and Technology is reworking a draft of a bill it wrote on the basis of a barebones one sent by the White House to Congress earlier in the year. The bill follows the 70-word White House proposal in calling for a single science adviser who, unlike his predecessors, would be subject to Senate confirmation. He would also have a say in national security matters.

To worry over the broader question of federal organization of science, a presidential study group would be set up to work with the new science adviser; it would report to the new Administration sometime in 1977.

A final bill probably will be marked up by the full committee in early October and passed promptly by the House, staffers say. But this schedule could slip because the committee's chairman and the bill's chief sponsor, Olin E. Teague (D-Tex.), suffered a stroke last July and has been forced to limit his congressional activities.

On the Senate side the prognosis is complicated by the fact that three separate committees have jurisdiction over the Administration's proposal. Moreover it is in the Senate that the most extravagant proposals for reorganizing federal science have cropped up. However, the three key senators involved, Edward M. Kennedy (D-Mass.), Frank Moss (D-Utah), and Warren G. Magnuson (D-Wash.), all publicly favor returning a science adviser to the White House; hence, they seem prepared to pass a bill which meets the Administration's wishes as soon as possible.—D.S.

Guerillas Throw Monkey Wrench into Chimp Research

Primatologist Jane Goodall has had to curtail field observations in Tanzania since the kidnapping of four of her white student assistants last May by guerillas from Zaire, reports the *Times Higher Education Supplement (THES)* of London. The victims were snatched up from the Gombe Stream Research Centre on Lake Tanzania, where they were keeping tabs on chimps, baboons, and red colobus monkeys. Now, because of the danger, only a small team of five African researchers remains at the station. Important continuity is being lost, as some of the individual chimps had been under observation for up to 10 years, according to the *THES*.

Goodall, a professor of human biology, continues to divide her time between Dar es Salaam (Tanzania's capital) and Stanford University, from whence came three of the kidnappees. All four were eventually released.

—C.H.

giene, boiling water, and wearing shoes instead of walking barefoot in parasite-infested soil.

The system of payment where everyone except plantation workers' families must pay for medical care encourages patients to delay coming to the hospital. Sometimes they can afford the cost of the medical consultation but cannot afford to buy the drugs that are prescribed. A government policy of supporting patient care more generously is a matter of urgent priority.

The Colombian experience has important lessons for this country as well. A modified service year in the United States—with newly trained internists, pediatricians, obstetricians, and surgeons working together in underprivileged areas—would not only benefit many patients but would also help young doctors sharpen their clinical abilities.

After struggling with Spanish for the summer, I come back with more empathy for foreign medical graduates practicing in this country. The experience has also let me see tropical illnesses first-hand and has given me the chance to improve some practical clinical skills. I have learned to reach decisions about patients without lab tests that I previously considered essential.

But the hospital, despite its optimistic beginning with United Fruit Company money and university affiliations, has not become the model for rural health care that was hoped. With a new director just appointed and a rapid turnover of doctors completing their rural year rotations, major changes are likely, but the direction of the changes remains uncertain.

Two overall impressions stand out. First, I was surprised by the almost complete lack of preventive, as opposed to curative, medicine. Perhaps the hospital cannot be expected to advance far in this area without more government action. Second, one cannot but admire the physicians of the Regional Hospital of Apartadó, who treat illness so well with so little.

—SAMUEL Z. GOLDHABER

Goldhaber, a fourth-year student at Harvard Medical School, was a news intern for Science *in 1970.*

Preventive Medicine: Legislation Calls for Health Education

It appears that therapeutic medicine, important as it is, may have reached a point of diminishing returns. The 12 to 15 percent increases that we are adding to our hundred billion dollar health care bill each year—even the portion that is not caused by inflation—apparently have only a marginal utility.—Conclusion of the task force on consumer health education of the National Conference on Preventive Medicine, June 1975.

It has been said that an ounce of prevention is worth a pound of cure. These days, we are plowing more than $104 billion a year into the health care industry, but not everyone is sure we are getting our money's worth. According to a recent report* of the Senate subcommittee on health, "it is clear . . . that progress in improving the health of the American people has not improved in proportion to our growing investment. Increasingly, questions are being raised regarding the efficacy of therapeutic medicine, which is the predominant emphasis of the health industry today. . . ."

Many of those questions are being raised by individuals who see in preventive medicine a chance to solve some of the medical problems that cannot be solved by therapeutic medicine alone. And those individuals are beginning to see some tangible results of their questioning. On 30 July, with barely a ripple of dissent, the Senate passed a disease control act that includes as one of its titles measures to increase federal and private activity in consumer health education for disease prevention.

The tenets of preventive medicine have a kind of compelling logic that is hard to deny, but the field does not have much sex appeal and has long been set aside by the public and the medical profession itself. (Doctors generally gain neither prestige nor power nor wealth by preaching the virtues of a sensible life-style.)

Testifying before the health subcommittee this past May, Anne R. Somers, associate professor of community medicine at Rutgers Medical School, referred to a study by Lester Breslow, dean of the School of Public Health at the University of California at Los Angeles and one of the leaders of the field. For 5½ years, she said, Breslow and his colleagues conducted a study of 7000 adults and concluded that certain simple health habits are associated with a longer life. These included: Three meals a day, with separate emphasis on breakfast; moderate exercise; seven or eight hours of sleep a night; no smoking; moderate weight; and moderate use of alcohol. Breslow's group reported that a 45-year-old man who practices three or fewer of these health habits can expect to live to be 67. The man who practices six or seven of them has a life expectancy of 78. "Where else, in the entire field of health care," Somers asks, "can you expect to get a payoff of 11 years life expectancy?"

Breslow's findings certainly were nothing new. Everyone knows that it is not good for your health to be fat, or fatigued, or malnourished, or often drunk. And maybe he is right about the payoff in terms of years. But it takes no special powers of observation to see that most people do not follow "preventive" advice. And as yet, in spite of the enthusiastic optimism of some individuals in public health, no one really knows how to persuade people, on a mass scale, to change their behavior in ways that will be good for their health. The evangelists of preventive medicine are stating that it is high time we tried seriously to find out, and they are seizing the moment to push for programs that would implement the few things that are known about changing human behavior.

The fact of astronomical health care costs and the perceived limits of what therapeutic medicine can do have combined to set a stage that is conducive to a new look at preventive medicine, which is coming into its own—at least on paper. The Senate's recently passed omnibus bill would establish within the Department of Health, Education, and Welfare (HEW) a high-level Office of Consumer Health Education and Promotion and a federally chartered private Center for Health Education and Promotion. The House is expected to consider the matter this fall. The Administration opposes the legislation.

During the past several years, a good deal has been said about preventive medicine and health education, but until now there has been no legislative action. In his health message to Congress in February, 1971, President Richard Nixon declared that "In the final analysis, each individual bears the major responsibility for his own health." Subsequently he created a

*Report—No. 94-330—on the National Disease Control and Consumer Health Education and Promotion Act of 1975.