Conduct of research and development of major departments and agencies (in millions of dollars).

Department or agency	Obligations				Outlays			
	1975 actual	1976 estimate	TQ* estimate	1977 estimate	1975 actual	1976 estimate	TQ estimate	1977 estimate
Defense—military functions	8,987	9,879	2,510	11,198	9,189	9,468	2,537	10,762
National Aeronautics and Space Administration	3,088	3,473	921	3,573	3,181	3,402	877	3,550
Energy Research and Development Administration	2,071	2,812	756	3,282	1,862	2,423	643	3,042
Health, Education, and Welfare	2,395	2,369	526	2,570	2,108	2,366	578	2,512
National Science Foundation	604	628	158	726	571	602	204	647
Agriculture	424	483	123	507	418	486	136	510
Transportation	291	340	76	319	307	338	74	304
Interior	296	332	80	316	265	307	83	310
Environmental Protection Agency	258	305	87	241	207	324	83	298
Commerce	222	247	63	243	220	239	64	233
Veterans Administration	99	108	28	106	97	99	26	100
Nuclear Regulatory Commission	61	97	23	109	54	88	23	103
Housing and Urban Development	57	62	16	70	52	57	19	67
Justice	44	65	11	41	44	50	14	44
All other	126	138	35	164	124	142	37	156
Total	19,023	21,338	5,413	23,465	18,699	20,391	5,398	22,638
Total, conduct of research	6,759	7,150	1,860	7,782	6,355	7,192	1,835	7,709
Total, conduct of development	12,264	14,188	3,553	15,683	12,344	13,199	3,563	14,929

*TQ denotes 3-month "transitional quarter."

to take the budget at face value. For example, because the FY 1976 HEW appropriations bill, which contains NIH's money, is caught in the veto holding pattern, it is unclear whether the total included in the President's budget ($687 million), the amount voted by Congress ($743 million), or some entirely different figure will be the one ultimately available to NIH for the current fiscal year.

What is clear, however, is that the Administration is asking Congress to hold the line on spending on cancer research and to distribute whatever increase in money is available among other NIH institutes and activities in order to begin to redress a balance upset by the recent NCI corner on the new money market. The National Heart and Lung Institute, which is number two behind NCI, both in size of total budget and rate of recent growth, would get $38 million in new funds, the largest such increment, to bring its FY 1977 budget up to $342.9 million. The National Institute of General Medical Sciences comes next with $25 million, to bring its total up to $193 million next year, and other institutes get increases which should begin to pull them out of the financial doldrums.

NSF

A big winner does seem to be NSF. The budget calls for total obligational authority of $802 million in FY 1977, an increase of $80.4 million or 11 percent. Obligations for basic research at NSF would go to $624.9 million, up about 19.5 percent. The RANN (Research Applied to National Needs) program would be cut from $73.6 million this year to $64.9 million next year, but NSF officials hasten to note that the cuts reflect shifts of substantial energy research projects and some other minor programs out of NSF, and that RANN is alive and well and still in favor at NSF. Science education activities would again be funded at the $65 million level of this year. Science education has been going through a reappraisal and reorganization process, in part inspired by congressional criticism of the foundation's curriculum revision programs, and the steady state funding indicates that the process is continuing.

—JOHN WALSH

Health Manpower: The Feds Are Taking Over

Should medical doctors, whose education is underwritten by the taxpayers, be required to repay their fellow citizens by working for a time in underserved areas in the inner city or in the countryside? Should this nation enact some form of mandatory service, a doctor draft, in which the needs of the people are put ahead of the preferences of individual physicians? Senator Edward M. Kennedy (D–Mass.) believes fervently in mandatory service for all new doctors because not one of them, not even those who pay their own tuition without benefit of scholarship or loan, is really paying his or her own way in full—the government is footing the bill for a substantial percentage of the real cost of each doctor's education. No one, Kennedy points out, "has a Constitutional right to a medical education." Therefore, those who get one owe their country something for it.

Representative Paul G. Rogers (D–Fla.) shares the goal of getting physicians to practice in the ghetto and in rural areas where doctors are few and far between. But he is adamant in his opposition to mandatory service as a means to that end. He believes the more democratic way to go about getting doctors where he wants them is to offer generous scholarships to buy a commitment to serve—voluntary rather than mandatory service.

Kennedy, as chairman of the Senate health subcommittee, and Rogers, as chairman of the House subcommittee on health and the environment, are the two members of Congress who figure most prominently in the present debate about health manpower legislation, which is high on the list of things on the agenda for 1976. A third important figure in the manpower legislation picture is Theodore Cooper, assistant secretary for health in the Department of Health, Education, and Welfare (HEW). Cooper fought hard and successfully with the Office of Management and Budget (OMB) over controversial retrenchments the budget office wanted included in any new manpower legislation. Last September Cooper was able to sketch out the Administration's bill in testimony before Kennedy, and in December the bill

itself was introduced in the Senate. Thanks to Cooper, it is essentially a bill that everyone can live with, which means things will be that much easier when the House and Senate finally meet to hammer out legislation that the President can sign.

Sooner or later, policy-makers are going to have to come to terms with the following issues if successful manpower legislation is to come into being:

▶Geographic maldistribution. Is mandatory service a sound way to address this problem?

▶Capitation or federal subsidy of schools on the basis of enrollment. Should it continue? Should there be strings attached?

▶Specialty maldistribution. Should the government set limits on the numbers of doctors that can enter residency training programs in various specialties?

▶Foreign medical graduates. Should immigration laws be changed to limit the numbers of foreign doctors who enter the country every year? Or should some other measures be taken to limit numbers of foreign doctors?

In almost all cases, the answer is sure to be yes. Up for reconciliation are various views about how the government should go about getting what it wants. Whatever happens, it is certain that the government is going to take more direct control of medical education and medical practice than ever before. As James F. Dickson III, one of Cooper's top deputies at HEW, recently told the Association of American Medical Collges, "... It is important to see clearly that the direction in which we are moving is toward increasing federal domination of the American health enterprise." And no one can be blamed more for this increasing domination than the medical schools themselves who patently have not moved vigorously to accommodate the demands of an impatient public. Medical schools have behaved as though the purpose of manpower legislation is to ensure their financial security. Now, they are being told explicitly that this is not the case.

The United States is in the throes of what members of Congress and the Administration call a "health manpower crisis." This crisis has been with us for more than a decade, although during the years perceptions of its nature have changed. In the 1960's, policy-makers were persuaded by manpower forecasters that the nation would be burdened with a severe doctor shortage by 1980. The government swung into action, enacting between 1963 and 1971 four pieces of legislation designed to produce more M.D.'s and other health professionals. In essence, the government said that taxpayers would pay medical schools to train more doctors, and the schools, hungry for money and anxious, as they said, to do their part for their country, agreed to the deal.

Now it must be kept in mind that manpower forecasting is among the most inexact of sciences—Princeton economist Uwe E. Reinhardt, who is an expert in this precarious field, has called forecasting "a task best described as 'Mission Impossible.' " In truth, no one really knew whether there would be a doctor shortage or not, but everyone believed there would be, which, as far as policy-making is concerned, is what counts.

Initially, the government supplied money for the expansion of medical school facilities and teaching programs. Then, with the landmark Comprehensive Health Manpower Act of 1971, it tied institutional support, in the form of capitation grants, directly to increased enrollments. The government forked over between $1700 and $2000 for every student a school admitted, somewhat less than the $2500 per head that Congress had authorized but welcome nonetheless.

More Medical Graduates

There is no question that the infusion of millions of dollars of federal funds over a 12-year period has served the purpose of producing more doctors. In 1960, 86 U.S. medical schools graduated about 7000 new doctors. By 1972, there were 112 schools turning out more than 10,400 graduates. Today there are 114 schools, and 10 more on the drawing boards. Approximately 13,000 men and women will receive a medical degree this year.

The tide had turned by 1972, and talk about a doctor shortage abated abruptly when Charles C. Edwards, then assistant secretary for health at HEW, announced one day that the nation faced a potential manpower crisis of another kind—a doctor surplus. Where before we had had too few M.D.'s, we suddenly were threatened by too many. This possibility forced Administration and congressional policy-makers to a new realization. Regardless of whether we have too many doctors or too few, the real problem is that we do not have enough doctors where we need them and those we do have are too often the wrong kind. It dawned on everyone that the true, but often unstated, purpose behind a decade's health manpower legislation was not just to produce more doctors but to produce doctors who would help redress social injustices that left poor people and country folk without access to medical care.

The manpower crisis became one of "geographic and specialty maldistribution," and it is these issues that lawmakers are addressing as they draft new legislation to replace the 1971 act that expired on 1 July 1974 and has been in effect since then on a continuing resolution that runs out at the end of this coming March. Previous attempts to agree on new legislation have failed utterly, but members of the House, Senate, and Administration promise that somehow they will get together in 1976, and say it will be sooner rather than later, although it might be unwise to count on that.

A brief comparison of the points that Rogers, Kennedy, and Cooper choose to highlight when talking about manpower legislation clarifies their differences. Cooper persuaded doubters in OMB that the federal government must continue to support academic health centers. "Consequently," he said recently, "there is no longer any talk of doing away with capitation for schools of medicine, dentistry, or osteopathy." The Administration proposes setting capitation at $1500 a head for medical, dental, and osteopathic students; phasing out capitation for veterinarians, optometrists, and podiatrists; and terminating capitation for pharmacy students (interestingly, the Student American Pharmaceutical Association has testified on the Hill that capitation for them be dropped, that tuitions be raised, and that the government simply provide larger supplies of loan money).

But the Administration is not offering capitation without strings. It would like to require all schools that get capitation support to set aside an "annually increasing percentage of their first year places for qualified students who voluntarily agree to practice in an underserved area"—15 percent in 1977, 20 percent in 1978, and 25 percent in 1979. (Kennedy wants 50 percent of places set aside.) The proposition is that, by linking this requirement to capitation, schools will be forced to change their ways and, among other things, expand training programs for physicians in rural and inner-city areas. The other capitation string is tied to producing family or primary care physicians. The Administration bill would require schools to create departments of family practice and to guarantee that eventually 50 percent of their residencies will be in family or primary care. No compliance, no capitation.

Another thing the Administration bill would do is consolidate a variety of existing scholarship programs in to one "conditional scholarship program." Participants would either have to serve in some federally designated program or another or pay back within only a couple of years of graduation twice the amount of support they received, plus interest at prevailing market rates.

Rogers, who strongly favors continuing

capitation support at present levels at least, says he can accept the idea of tying it to a requirement that schools establish a department of family medicine and he was willing to tie it to limits on residency programs as well, although the House refused to adopt the latter provision in its bill. Where Rogers diverges notably from the Administration and Kennedy thinking is in the matter of forcing all, or some, students to accept conditional scholarships.

Rogers strongly endorses the National Health Service Corps (NHSC) scholarship program and believes, if it were expanded, enough students would be interested in taking scholarships in exchange for a commitment to serve that the geographic maldistribution problem would be resolved. Considering the present cost of medical school tuition and the fact that it is going nowhere but up (some schools are talking

Briefing

Executive Branch Readies for New Science Setup

In anticipation of the new law creating an office of the science adviser in the White House, the National Science Foundation has demoted those offices it created in 1973 to serve its director, who at that time became the President's science adviser. As of 9 February, both the Science and Technology Policy Office and the Office of Energy Policy, which previously reported to the director, will be rolled, along with the Office of National R & D Assessment, into a subgroup reporting to one of NSF's assistant directors.

And, to get the work of the new offices started, the two interim advisory panels appointed by the President have been meeting and have drawn up a long list of possible projects. The idea, they say, is to get the work of the new office started.

The most original of these is a proposal for a "science court," which has the enthusiastic backing of Vice President Nelson Rockefeller, and will be run by a member of one of the committees who has been a long-term champion of the notion, Arthur Kantrowitz, of Avco-Everett Research Laboratories. The group hopes to find a federal agency willing to fund an experimental "trial" of the technological elements of some public controversy.

Another project will be an exercise in creative thinking on the question of how science and technology can have an impact on the world food situation, to be run by Hans Mark, director of the Ames Research Center. J. Herbert Holloman, of Massachusetts Institute of Technology will study technology and innovation. Arthur Bueche of General Electric Corp. will review the effects of federal regulation on the advance of science. The committees have also discussed holding a 2-day symposium to examine the funding and the health of basic research.—D.S.

Von Braun Seeks to Stir Up Sagging Space Interest

Wernher von Braun, master rocket builder for America's space program, has emerged from the low profile he maintained after quitting the National Aeronautics and Space Administration in 1972 and now, at the age of 64, is trying to get off the ground with his latest vehicle, the National Space Institute (NSI).

In two recent press conferences von Braun said that his outfit is different from existing space organizations, which spend all their time talking to themselves. The purposes of the NSI are twofold: one is to start a grass-roots movement to get the American public space-minded again. The other is to acquaint private industry with the benefits to be gained from utilizing government space-related research and development.

Von Braun feels that interest in space has lagged among a fickle public just at the point where the real returns for the investments of the 1960's should be rolling in. He likens the country to a farmer who has carefully sown and tended his orchard and who, now that the fruit is ripening, says he can't afford to hire pickers.

Von Braun believes all the earth's problems can be tackled with the aid of space technology—from new manufacturing activities made possible in zero gravity, to satellite communications and earth resources monitoring, to the construction of planetary colonies and orbiting habitats. "Space takes the lid off the pressure cooker called earth," says he.

The NSI has a small staff quartered in Arlington, Virginia, an estimated annual budget of $300,000, and a starry board of directors including broadcaster, author, and all-around enthusiast Hugh Downs, now cast as NSI vice president; Boy Scout executive Alden G. Barber; Fulton J. Sheen; Barry Goldwater; Jacques Cousteau; Shirley Temple Black; Issac Asimov; James Van Allen; and Bob Hope.—C.H.

Science Advice: Problems and Prospects

On 21 January, the Senate Committee on Aeronautical and Space Sciences, the first of three committees that must do so, gave its approval to a bill restoring a presidential science adviser to the White House. The action indicated that the committee staffs, Senate Republicans, and the White House have agreed on a version of the measure that can sail smoothly through the Senate, be altered in conference with the House, and be signed by the President, probably in March. Previous Senate draft versions of the bill had aroused Administration opposition, and hence the ire of Senate Republicans, mainly because the future science adviser would be given too much power (*Science*, 16 January).

Besides the aeronautical committee, approval must be given by the Commerce Committee and the Committee on Labor and Public Welfare, both of which are expected to act before the end of January. The new version somewhat lessens the power invested in the science adviser in previous versions of the Senate bill. For example, instead of being a full-fledged member of the National Security Council, he now would only advise the council at its request. A requirement that the President explain any budget disagreement between him and his science adviser—objected to strongly by the White House—has been modified. Other features to which the White House objects, such as a program to disseminate science and technology to state governments, remain.

The mood of staffers negotiating the legislation has mellowed in comparison to that of past weeks, when there was considerable friction over who was

about tuitions in the $10,000 to $12,500 range for next year), Rogers maintains, with a certain logic, that there are plenty of students who would voluntarily seek an NHSC scholarship, which covers tuition plus a stipend for living expenses, in exchange for service in rural or inner-city areas. An informal survey recently completed by one member of his staff showed that medical school deans estimate as many as 85 percent of students would gladly take the scholarship. Therefore, says Rogers, "I oppose mandatory service as proposed by Kennedy as unnecessary, of questionable constitutional validity and as unwarranted social policy."

Kennedy, now as before, is running into trouble in the Senate because the tone of his proposals suggests a direct intervention in the affairs of medical schools and medical practice that many people find hard to

trying to do what. "It's still a camel of a bill," commented one Senate staffer about the new version, "but I think that it is one we can get through the Senate."—D.S.

Goodbye Holifield, Hello Oak Ridge

Tennessee residents, civic groups, and scientists were dismayed in 1974 when Congress changed the name of their beloved Oak Ridge National Laboratory, which nestles in the mountains west of Knoxville. It was thereafter to be known as the Holifield National Laboratory, in honor of Chet Holifield, the Democratic congressman from California, who was then retiring after serving 30 years as a key figure on the Joint Committee on Atomic Energy. But now, after a year of struggle, the Tennesseans have succeeded in changing the name of the institution back to its original form.

This welcome relief was provided through amendments introduced by the Tennessee delegation in both the House and Senate to the fiscal 1976 authorization bill for the Energy Research and Development Administration, the agency that supports Oak Ridge's principal activities. But the Tennessee delegation did not completely slight its former partner. An accelerator at Oak Ridge, now under construction, will be named the Holifield Heavy Ion Research Facility.

Staffers there say that for the last year the laboratory has led a schizophrenic existence. "It's remarkable how little the name of one congressman, even a very important congressman like Mr. Holifield, is known nationally," says one official, remarking on the ignorance which visiting high school students, tourists, and other members of the public have displayed about the significance of the Holifield name. And, since efforts were under way to change the name back, the laboratory's management decided that the place would be Holifield for purposes of official government business and Oak Ridge for purposes of scientific communication. Thus, technical journals, reports, and scientific papers have been emanating for the last year from a laboratory that, as far as Uncle Sam was concerned, didn't exist.—D.S.

Wise Men to Scratch Heads over Nuclear Issues

Not content with the number of nuclear energy studies already completed or under way around the country, the Ford Foundation has just announced it will spend $679,354 for a blue-ribbon academic group to make a 1-year study of civilian nuclear power issues. The aim, according to the foundation's announcement, will be to "highlight the critical issues" and to make recommendations, because the subject has, in the last year or so, become so acrimoniously debated and confused in the public mind.

The panel plans to operate as a free-wheeling think tank; members will read the literature, listen to outside experts, and shape their deliberations in any direction they see fit. Issues covered could include the economics of nuclear power, nuclear safety, waste disposal, and international controls. The odds seem good, however, that the international and arms control aspects of the issue will be studied thoroughly, since the panel includes several arms control experts including its chairman, Spurgeon Keeny, Jr., a former assistant director of the Arms Control and Disarmament Agency. Keeny is now with the Mitre Corporation, which will be the recipient of Ford's money and run the project.

The blue-ribbon panel is made up of a battery of university presidents, prominent academics, and arms control experts, who were chosen partly because they had not taken hard positions on nuclear power issues. Panel members themselves are expected to perform the study. As one foundation official said, "These wise people are in fact going to do the work; the only staff is a secretary."

By contrast, the wide-ranging Energy Policy Project, which the foundation supported at the time of the 1973 Arab oil embargo, was largely staff-run, with its board of directors playing only a nominal role. Still another major study, the $2 million look at technological choices and research strategies on nuclear energy just launched by the National Academy of Sciences, will operate through some 25 subpanels reporting to the main committee (*Science*, 5 December 1975).

Members of the foundation's new study group are Kenneth J. Arrow, Harvard University; Harold Brown, President, California Institute of Technology; Albert Carnesale, Harvard University; Abraham Chayes, Harvard Law School; Hollis B. Chenery, Vice President, International Bank for Reconstruction and Development; Paul Doty, Harvard University; Phillip J. Farley, Brookings Institution; Richard L. Garwin, IBM Corporation; Marvin L. Goldberger, Princeton University; Carl Kaysen, Institute for Advanced Study; Hans H. Landsberg, Resources for the Future; Gordon J. F. MacDonald, Dartmouth College; Joseph S. Nye, Harvard University; Wolfgang K. H. Panofsky, Stanford Linear Accelerator Center; Howard Raiffa, John F. Kennedy School of Government, Harvard University; George W. Rathjens, Massachusetts Institute of Technology; John C. Sawhill, President, New York University; and Thomas C. Schelling, Harvard University.

Besides this project, Ford has awarded $175,000 to Princeton's Center for Environmental Studies to study the international plutonium economy. An added $20,000 will go to Massachusetts Institute of Technology to support work on a global model of energy supply and demand.—D.S.

accept. At this point, the substance of the bill he will introduce is uncertain, but staffers have been working hard in recent weeks to hammer it out. However, he has expressed relative satisfaction with the Administration's bill and is likely to incorporate many of its features. Speculation is that he will include an amendment to the immigration laws to stem the flow of foreign medical graduates who are currently receiving licenses to practice in this country in about the same numbers as American doctors. The fate of an extremely controversial provision that doctors be relicensed every 6 years is undecided.

For all the uncertainties in the present legislative dance on Capitol Hill, it is certain that, whatever the outcome, medical schools will never be as free to go their own way as they have been in the past. And, if past experience in the manpower business is any indication of future events, one must conclude it is not certain that measures now being contemplated by Congress and the Administration will succeed in achieving the desired end.

Merlin K. DuVal, a former assistant secretary for health who is now a vice president at the University of Arizona, has aptly pointed out that, during the past 16 years, there have been at least eight full-scale reports by major organizations on the manpower problem. "That none of these reports . . . should have sufficed is, itself, testimony to the difficulties that are associated with accurately assessing the health manpower needs of the United States. Furthermore, that so many such efforts were undertaken at all is rather clear evidence that neither the medical profession nor the political leadership in the United States is entitled to any feeling of confidence that it knows what it is talking about in addressing this same problem today."—BARBARA J. CULLITON

Color Additives: Botched Experiment Leads to Banning of Red Dye No. 2

A deft legal maneuver by Food and Drug Commissioner Alexander M. Schmidt has enabled his embattled agency to climb free of the wreckage of a ludicrously botched experiment on the safety of the controversial color additive known as FD & C Red No. 2. After a frantic 10 days of searching for a way out of the Red 2 imbroglio, Schmidt announced on 19 January that he would ban further use of the dye in foods, drugs, and cosmetics.

Just 2 months earlier his own Bureau of Foods and several members of an expert advisory committee had seemingly given the dye a clean bill of health. But in the interim a new statistical analysis of previously considered data suggested that Red 2 might well cause cancer. The results of the new analysis, which surprised most of the experts who were reviewing the status of Red 2, raised questions in some minds as to the adequacy of the testing and analytical procedures traditionally used by the Food and Drug Administration (FDA) to determine the safety of food chemicals.

Red 2 has been the most widely used food color in this country, and it has always been touted as the "most thoroughly tested" of all the food colors. Yet questions were raised in the early 1970's, largely on the basis of tests conducted in the Soviet Union, as to whether the dye might cause cancer or reproductive damage.

In an effort to answer these questions, two major tests were conducted by FDA. One, a collaborative effort involving two FDA laboratories and a commercial laboratory, concluded that Red 2 does not cause reproductive damage. The other, also originally launched as a reproduction study but then adapted to examine the question of carcinogenicity, soon became such a muddle that it is routinely referred to by FDA scientists as the "botched" or "bungled" study. Yet it is this study which formed the basis for the recent regulatory decision on Red 2.

The study involved feeding Red 2 to four different groups of rats, each at a different dosage level, and then comparing the health of these treated groups with the health of a control group. There were 500 rats in all—seemingly enough for a solid evaluation. But the study was left unsupervised for a long period of time after a scientist was transferred, and it developed two serious flaws. To begin with, the animal handlers managed to put some of the rats back in the wrong cages part way through the experiment, so that an undetermined number of rats were shifted among the control group and the four treated groups. Second, the animal handlers were lackadaisical about retrieving dead rats from their cages and rushing them off to the pathologists for examination. As a result, virtually all of the rats that died during the course of the experiment were so badly decomposed as to be of little use for evaluation. Only those rats that survived to the end of the experiment and were killed—some 96 in all—were available for detailed histopathological examination. "It was the lousiest experiment I've seen in my life," commented one scientist who reviewed the data.

Yet the study was not considered a total loss by the FDA, which reasoned that it would be possible to treat the intact animals which had been fed the largest dose of Red 2—3 percent of their diet—as a "high dose" group and all the other intact animals as a "low dose" group. By comparing the two groups, the reasoning went, it might be possible to learn *something* about whether Red 2 is carcinogenic.

A key role in making this determination was to be played by the FDA's Toxicology Advisory Committee, a group of government and outside scientists which was formed last year to deal with just such perplexing and controversial issues as the safety of Red 2. The committee held its first meeting in late November and, to judge from the proceedings, it appeared that Red 2 would be exonerated from suspicion as a carcinogen. The pathology division of the Bureau of Foods submitted a report on the "botched" experiment which concluded that Red 2 had "no apparent adverse effect" on the rats. And many members of the advisory committee seemed to agree, offering such comments as, "I have a feeling that this is an innocuous color" and, "There has been no evidence that I have seen which makes me think that this compound is a significant or major carcinogen."

Still, just to be certain, the committee ordered up three further analyses by experts within its membership. One of those studies—a statistical analysis of the results of the "botched" study performed by David W. Gaylor, principal biological statistician at the FDA's National Center for Toxicological Research in Arkansas—revealed that the Bureau of Foods may have been a bit too hasty in drawing its rosy conclusions. Gaylor found that, while it was indeed true that there was no significant difference in the *total* number of tu-