AAAS

R&D budget: In '82, only defense gains

Basic Research in the FY 1982 Budget

(Budget Authority in millions of dollars)

	FY 1980 Actual	FY 1981 Est.	FY 1982 Approved by Congress	Percent Change (Current Dollars)		Percent Change (Constant FY 1980 Dollars)	
				From 80	From 81	From 80	From 81
Health and Human Services	$1762.4	$1862.1	$1939.6[1]	+10.1	+ 4.2	− 7.3	− 4.4
NIH	(1643.5)	(1745.6)	(1825.9)	(+11.1)	(+ 4.6)	(− 6.5)	(− 4.0)
NSF	829.9	858.3	903.8	+ 8.9	+ 5.3	− 8.3	− 3.3
Defense	551.9	616.5	698.9	+26.6	+13.4	+ 6.6	+ 4.1
Energy	522.5	593.7	644.8	+23.4	+ 8.6	+ 3.9	− 0.3
NASA	559.2	540.8	556.6	− 0.5	+ 2.9	−16.2	− 5.5
Agriculture	279.5	319.0	334.2	+19.6	+ 4.8	+ 6.8	− 3.8
Interior	71.9	76.6	77.0	+ 7.1	+ 0.5	− 9.8	− 7.7
Smithsonian	40.8	44.1	49.7	+21.8	+12.7	+ 2.6	+ 3.5
Commerce	31.1	33.6	35.7	+14.8	+ 6.3	− 3.3	− 2.4
All Other	66.5	68.5	61.7[2]	− 7.2	− 9.9	−21.9	−17.3
Total	$4715.7	$5013.2	$5320.0	+12.8	+ 6.1	− 5.0	− 2.6
Defense component of total	($551.9)	($616.5)	($698.9)	(+26.6)	(+13.4)	(+ 6.6)	(+ 4.1)

[1] Subject to application of $20 million general reduction in salaries and expenses for all of HHS.
[2] Subject to application of 4% reduction to Labor and Education.

Shapley, Teich and Weinberg

"[T]he best overall quality of research may not occur in times of accelerating support," says Presidential Science Adviser George A. Keyworth II, "but in times of moderate restraint that force qualitative decisions." If so, the next few years should provide ample stimulus for quality. An AAAS analysis highlighting congressional action on the fiscal year 1982 research-and-development budget indicates that few areas outside of the defense community fared comfortably during this past year's budgetary parings. And from the rumblings heard on Capitol Hill, one can expect to see much the same for FY 1983.

Appropriation bills for FY 1982 have passed for all but a few agencies (such as the Department of Health and Human Services, of which the National Institutes of Health is a part). And once uncertainties over line-item spending and yet-undistributed reductions clear, R&D appropriations will probably total roughly $40 billion. That's about 5.4 percent less than President Reagan requested in March (SN: 3/14/81, p. 164), but 2.2 percent more than he asked for in budget revisions proposed last September.

In current dollars, this $40 billion represents an 8.1 percent increase over the federal funding available for FY 1981, and a 20.9 percent increase over the two-year period 1980 to 1982. But the only sector to come out clearly ahead has been defense, according to the budget analysis prepared by Willis Shapley, Albert Teich and Jill Weinberg at the AAAS. In constant dollars (based on an assumed inflation rate of 9 percent annually for FY 1981 and 1982) defense R&D experienced a real growth of 22.2 percent over the two-year period ending in FY 1982, while non-defense R&D spending showed a "real decline of 16.1 percent."

This renewed emphasis on defense seems part of a global trend. According to AAAS President D. Allan Bromley, "Military expenditures worldwide are now at about $500 billion per year — or about $125 per person." And he adds that those military expenditures "are escalating at about $50 million per day."

Though total FY 1982 appropriations for basic research have not yet been defined by the agencies, a total of $5.3 billion is expected — 7.3 percent more than would have been available if Congress had faithfully answered Reagan's September call for additional across-the-board budget cuts of 12 percent. In constant dollars, though, total basic-research support is declining.

But there were a few small gains. Science-education programs within the National Science Foundation are earmarked to receive a small increase — $12.3 million — over the levels slated in March. Biological, social and behavioral sciences at NSF will also increase — 16.3 percent, to $240 million. —*J. Raloff*

AAAS

Seedless gardening by tissue culture

Vats of individual plant cells, growing in fermenters like those used for microorganisms, can produce economically important substances now derived from fields and forests. At the meeting of the AAAS, E. John Staba of the University of Minnesota described progress in producing plant chemicals by maintaining cells, tissues and organs without the rest of the plant. "Cell, tissue or organ cultures more often than not produce specialty chemicals and sometimes in quantities greater than the plant," he says. "But systems, even if close to success, are not yet economically competitive [with current production methods]."

The possibilities for deriving plant substances from tissue culture cover a broad range of materials. "Choose any plant product, and someone is interested," Staba says. Sweeteners, bitters and flavors such as vanilla and rose oil are in demand for food; aromatics, spices and gums for cosmetics; pesticide components such as pyrethrins for agriculture; hydrocarbon sources and natural rubber for industry; and analgesics, cardiac drugs and antitumor agents for pharmaceuticals.

A variety of active cell systems already have been reported that make a significant amount of targeted plant products. For instance, almost any cell in the coffee plant when put into tissue culture will make caffeine, as up to 1.5 percent of the dry weight. Caffeine, unfortunately, is not the most economically valuable component of the caffeine plant. So far no culture system has produced material mimicking the important aromatic properties of natural coffee beans.

Staba suggests that complex substances, such as coffee, will require culture of plant organs, made up of a variety of types of cells. Other plant cell culture systems have already produced an ingredient of a laxative, a pigment, a steroid and a terpene. The terpene was produced as 15 percent of the cells' dry weight.

The Japanese are closer to the commercial use of plant tissue culture processes, Staba says. Researchers in both Japan and Germany have scaled up operations to 5,000-gallon fermenters. There are still challenges to growing uniform cultures of plant cells and organs economically, but Staba thinks these problems will soon be solved. More difficult challenges include learning how to make cells express the genes for the desired product and determining how different types of cells within a plant interact.

Methods of maintaining individual plant cells, isolated tissues and organs growing in laboratory culture also provide the bridge between genetic engineering techniques and their agricultural applications. Laboratory cultures can be manipulated to create new combinations of plant genes. Then if plants can be regenerated from the altered cells, many of the standard problems of plant breeders are avoided — the barriers of natural reproduction, long life cycle and large size of some economically important plants.

An important application of cell and tissue culture can be the improved production of forest biomass by providing new types of trees and better methods to replace the millions of trees cut annually, says Donald J. Durzan of the University of California at Davis. "Cell and tissue culture saves time and space in the domestication process," Durzan says. "The reproductive doubling times of cells takes hours and days, whereas that of individual trees takes decades or centuries." The advantages of the process include the ability to make multiple copies of a new variety to test in many environments and the possibility of screening millions of genetically different cells in a test tube. "If manipulated cells were to be grown into trees, we might be able to develop new, exotic or superior individuals comparable in yield or exceeding the productivity of plants currently being domesticated," Durzan predicts. —*J.A. Miller*