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**COVER** Topological maps of electron densities for diamond (upper) and silicon (lower). Red disks represent atoms and red lines are drawn along the scaled covalent bonds in a 110 plane. The pileup of electronic charge forming the covalent bonds has two peaks for carbon and one for silicon because of the lack of *p* electrons in the carbon atom core. It is speculated that this is the origin of the difference in the multiple bonding character of these elements and why "carbon gives biology, but silicon gives geology." See page 549. [Marvin L. Cohen, University of California, Berkeley 94720; design executed by Margareta Slutzkin and Marianne Friedman, M and M Graphic Designs, Oakland, CA]

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## Overhead and Symbiosis

Basic research in the United States depends on one of the most highly selective symbiotic relationships in nature. It is largely carried out by a combination of cheap labor (called "professors") and ultracheap labor (called "graduate students"). They are housed in impoverished institutions (called "universities") that are continually begging for funds from wealthy aunts (called "private donors") and a very wealthy uncle (called "the federal government"). Everyone should be delighted by this arrangement. The federal government gets fundamental research at a cheap price, the universities obtain funds to help them in their primary mission of education, the students obtain a subsidy during their apprentice period, and the private donors get the psychic satisfaction of contributing to a worthy cause.

Disaster looms when individuals in a symbiotic system reason that if one is getting enough of a good thing, it might be better to have even more. The universities decide that the rich aunt and uncle will never notice if a small amount of their money is diverted to help a group of the worthy downtrodden (called "the humanities"). The research investigators complain that "their" money is being diverted and forget that universities need to maintain an atmosphere in which ideas flourish. The federal government gets nervous and demands increasingly detailed accounts of time and effort. Over the last 20 years overhead rates have doubled, from an average of 20 percent to one of 40 percent. In addition, there are vast discrepancies: overhead varies from 30 percent in some universities to 100 percent or more in others. No one really believes that an institution with a 30 percent overhead is very efficient and one with a 100 percent overhead is a bunch of fumbler. Rather, they regard the high rate as a clever way to enrich that institution with federal money. University administrators, spurred by either envy or altruistic passion, then try to get "their fair share" by creative financing.

It is, therefore, pleasant to note that a first step in bringing this problem into line has now been taken by the Office of Management and Budget after discussions with a representative group of university administrators and scientists. A flat 3.6 percent cap on allowable indirect costs for the salaries of professors and department chairmen has been set, and federal requirements for detailed effort reporting have been eliminated. Negotiations on caps for other portions of indirect costs are under way. Some flexibility will be needed to allow for minor variations, but the wide range existing today needs to be curtailed.

A fixed national rate would have numerous advantages. First, it would provide an incentive to be more efficient. Second, with a flat fee, all institutions would of necessity pull together for an equitable system rather than compete with each other for a dwindling share of research dollars. Those who enjoyed manipulating the system in the past might argue that each university is a special case. There are extra heating needs in Minnesota and extra air conditioning needs in Texas, but they tend to compensate for one another. The overhead should be sufficiently handsome to provide an optimistic atmosphere that generates originality.

Another way to minimize future problems is to make the overhead contracts more explicit and more uniform. Both the institution and the investigator will then know what the investigator is entitled to receive and what the university is required to give. At present, there is considerable bitterness when grants are charged for items the investigator believes should be part of overhead. It is frequently difficult to obtain a copy of the overhead contract and even more difficult to decipher it. After clarity should come a willingness to adapt. If the originally set maximum percentage of overhead is too low, it may have to be adjusted to reflect reality. But at least the correction would be a concerted effort in a common cause.

To be generous is very important. Universities are always strained for funds, and education becomes more complex in our sophisticated society. The new tax bill may be particularly hard on private universities, and they cannot be allowed to fail. Yet symbiosis requires restraint from all parties. It has been said that a gentleman is one who has more privileges than he chooses to exercise. The shift from symbiosis to parasitism can be caused by a slight deviation beyond what is appropriate. The beginning step that has been taken provides a good foundation for future progress. The system needs to be preserved and improved.—DANIEL E. KOSHLAND, JR.