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Who Should Pay for Science?

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As Congress considers cuts in science funding, lamentations are rising. "We're dominated by fools," said one Democrat. "At risk is the type of Government-financed research that has put men on the moon," intoned the *New York Times*. "Such cuts portend wide changes in American science and American life." A few years ago, a Harvard physicist compared federal refusal to build the Superconducting Supercollider to medieval Europe allowing itself to be overrun by the Moors.

All hype. There is no reason for taxpayers to support trips to the moon, particle physics, or any other research not directly serving defense against external or internal aggression, the core function of government. Funds for basic research can be allocated by the market.

Bear in mind that, while some socialized science is worthwhile--weather satellites, for example--private industry, not the government, manufactures the satellites and the launch vehicles. Agencies like the National Bureau of Standards that run their own facilities buy their equipment from these contractors. (Dupont, not "the Manhattan Project," built the plant that made the plutonium for the atom bomb; had it had the will and the money, it could have built the plant on its own.)

All government does is channel resources, thereby influencing what problems will be explored and who will do the exploring. The question is whether the government has any more business doing this than it has deciding what shows run on Broadway. An author wishing to have his play produced solicits the support of investors, whose decision to buy in is influenced by idealism plus the number of tickets the play is thought to sell. It is not too much to ask scientists wishing to perform experiments to find backing in the same way.

Much research is already market-driven. Pharmaceutical firms fund development costs, and in the process supply a cornucopia of new medicines. Altruistic alumni support university laboratories. The system of weather and communication satellites, if profitable, would certainly be self-supporting once privatized.

Sure, runs the reply, but that's because most people grasp the practical applications of science. The big argument for subsidizing fundamental research is that it is over nearly everyone's head. Just as the average person has a sufficiently clear idea of what breakfast is all about to decide for himself whether to try a new cereal, he knows enough about how he feels to choose medications. When he lacks expertise, but knows what the experts think, he can rely on their judgment--reading only critically acclaimed

books, and taking tests his doctor orders. But the average knowledge consumer cannot evaluate basic research. Unfamiliar with curved spacetime and the zoo of elementary particles, unable to understand so much as the titles of articles in physics journals, he cannot even evaluate evaluations. He has no way of deciding whether to help finance searches for gravity waves or proton decay.

Market transactions *based on adequate information* may satisfy all transactors, but too few people know science for success in the marketplace to measure the value of basic research. Hence (the argument concludes) government must direct resources where the scientific community says they should go.

The flaw in the argument is that it overlooks the scientist's obligation to get his ideas across. After all, a would-be researcher is selling something; in exchange for support, he offers to pursue certain lines of inquiry. If he wants any takers, therefore, he had better be able to explain what he wants to find out and why finding it out would be good.

He hardly bears this burden alone, for all new products are to some degree unfamiliar, and must be explained to the public. People were not born knowing the advantages of automatic transmissions over manual. Vladimir Zworkin had to persuade the management and ultimately the stockholders of RCA to fund his research into the wireless transmission of images. The uses of television seem obvious to us now, because they have shaped our world; Zworkin lived in a different world, most of whose inhabitants were as familiar with electromagnetism as we are with the topics of current research.

A researcher can persuade others to support him in numerous ways. His sales pitch, like Zworkin's, might be the prospect of a lucrative new technology. Research has epistemic as well as financial rewards: a scientist can appeal to the intellectual curiosity of his peers, pointing out how his project might help their own research.

Most psychologists interested in the heritability of personality traits would be happy to support a study of the heritability of alcoholism, for instance. A scientist might offer a subscription service, publishing a newsletter for contributors to keep them posted on breakthroughs. (Thus did Isaac Newton's *Principia Mathematica* come into the world; a number of Newton's acquaintances put up the money to allow him to publish it, and in return they received copies.) He can try to make his case to laymen in laymen's terms.

Should he fear his ideas are too abstruse, he might seek to interest professional sages like Carl Sagan who have the public's ear. Ernest Rutherford once said, "If a piece of physics cannot be explained to a barmaid, then it is not a good piece of physics." Rutherford may have exaggerated, but if the barmaid can't understand the physics, why should she be expected to pay for it?

Suppose a scientist proves unpersuasive, he enlists no support, and his experiment is not done. An unwanted service has been removed from the market, whether we say the public is blind to its own interest, or that our man failed to make them see it. But--the second argument for subsidized science--don't we lose knowledge, and didn't I as much as admit, when I mentioned intellectual curiosity, that knowledge is good? Of course it is, but, like every other good, its acquisition carries costs which must be balanced against benefits.

Not all knowledge is worth having. Nobody cares how many blades of grass there are in Central Park. Some knowledge that might be worth having cheaply--like what all your associates really think of you--is too expensive. You have better things to do than snoop around the office all day. The human race does not have the resources to answer every question. Choices must be made. On the principle that those who want something should be the ones who pay for it, those who want a particular question looked into

should be the ones who finance the looking.

It is often said that basic research has become relatively expensive. So it has, for the simple but momentous reason that most of what can be learned by observing the world under normal conditions has been learned already. Galileo determined the laws of motion by rolling balls down a few home-made ramps.

New knowledge today requires tremendous energies (subatomic particles are hard to smash) and exquisitely sensitive instruments (gravitational waves, if they exist, are minute), both of which are costly. But to take this as warranting subsidies for science is like arguing that, since movies are much more expensive to produce than they used to be, the government should subsidize Hollywood.

Much highly touted federally funded research is actually of dubious scientific value. For \$25 billion the Apollo Program discovered that the Moon is made of rock, which everyone knew already. Incredibly, the Hubble Telescope, admittedly a remarkable instrument, has been placed in low Earth orbit and will burn up in the atmosphere in a few years.

Everything done by the manned Space Shuttle could be done far more cheaply by robots. When the Shuttle ferried astronauts to repair the Hubble, a scientist associated with the former Soviet Union's own moribund shuttle program observed that the rescue mission cost more than a new Space Telescope would have.

But the worst byproduct of tax money for science, I suspect, is its corrupting effect, as scientists angling for that money distort and exaggerate their research to make everything appear a matter of "national interest" (and universities rate faculty by their ability to attract such money).

Some years ago there appeared in a philosophical periodical an article entitled "Semantic Theory and the Word 'Good.'" It was perfectly decent, but, as its title suggests, not of great interest to anyone outside a circle of academic specialists. Yet, on looking at the footnotes, one discovered that the research for it (which consisted of sitting in an armchair and thinking) had been supported by the Air Force. Somehow, the author had convinced the Pentagon that the future of the Republic hinged on issues in the philosophy of language. There is a fundamental dishonesty about such affairs, and honesty, one would think, should be the first virtue of scientists.

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