

Playing Well With Industry

It's noon, and strains of Pachelbel's Canon are floating down the staircase of a Pompeu Fabra University building in Barcelona, Spain. Most visitors heading up to Xavier Serra's Music Technology Group would be surprised to find that the music comes not from a violin but from a computer. Serra feeds the computer a musical score, and the machine generates the appropriate sounds; the goal is for the music to sound like a human-operated violin. It's one of several research projects in Serra's lab that are funded by musical-instrument manufacturer Yamaha.

Serra's collaboration with Yamaha is a consequence of a natural alignment of interests; developments in music technology, he says, require this approach. He admits, however, that the money comes with some strings. Industry's primary goals—to make new products and generate money—often align well with the interests of academic researchers. But they rarely align perfectly. So, although industry is an important source of funding for academic research, industry-funded scientists have to be careful to “manage this balance between academic and industrial needs,” as Serra puts it.

The lure of industry money

In a U.S. survey conducted in 1995 by Eric Campbell, a health policy researcher at Massachusetts General Hospital and Harvard Medical School in Boston, and his colleagues, more than a quarter of life-science faculty

members reported receiving support from industry through grant agreements and research contracts. At a time of tight government budgets, the private sector's deep pockets are a provocative lure. “We are now being encouraged to do this because government funding is slowing down and the university is realizing that there must be other sources of funding to keep the research enterprise alive,” says Arijit Bose, a chemical engineer and department chair at the University of Rhode Island in Kingston, who has funding from Honda.

Industry funding fills niches that the government can't or won't fill. “Very few of the major drugs that exist today would exist if it wasn't for relationships between companies and researchers. It helps bring the results of science into the market,” says Campbell.

Ethics experts, scientists, advocacy organizations, and the public often worry about the influence of the profit motive on research. For

decades, the tobacco industry has been criticized for funding biased research and using the credentials of high-profile scientists to boost the companies' public image (*Science*, 7 January 2005, p. 36). And in January, the Center for Science in the Public Interest, a nonprofit advocacy organization in Washington, D.C., charged that U.S. universities are giving oil and gas companies too much control over the choice of on-campus research projects, first rights to intellectual property (IP), and the power to review and delay publication. The risk is especially acute in biomedical research. “People worry that relationships with industry may induce investigators into doing things such as inappropriately recruiting people in [clinical] trials and in the same way manipulating data and results,” Campbell says. Industry-funded researchers “are less likely to have results disfavoring a company.”

Industry links can also foster secrecy. “Those who are involved in academy-industry relationships are more likely to withhold data and not share data,” says Melissa Anderson, an ethics researcher at the University of Minnesota, Minneapolis. Academic scientists may agree to restrictive conditions when initiating industry relationships, and they may feel pressure later to sweep negative results under the rug. “If drugs are proved not to be effective or to have some bad effects, [there may be] pressure not to publish these findings at all,” Anderson says.

But “some of these negative effects”—bias, secrecy, and other competing interests—“are no worse than what scientists could have without industry,” Anderson says. “Every scientist must abide by the rules and policies of his or her own institution,” whether or not there is a company involved.

Industry gifts: A free lunch?

When Magdalena Balazinska, a database and information-management researcher at the University of Washington, Seattle, received a 2-year graduate fellowship, and then a New Faculty Fellowship worth \$200,000, from Microsoft Research, the money came with no IP agreements, no restrictions on her right to publish, and no research mandates. Microsoft never tried to “control what we do nor [did they] expect us to do something specific,” Balazinska says. Her experience isn't unusual: Industry gifts of reagents and equipment, fellowships, and grants that come with few strings attached are relatively common in the research world.



Other people's money. Xavier Serra (left) gets research funding from Yamaha; Magdalena Balazinska has received fellowships and grants from Microsoft and Cisco Systems.



For many researchers, however, industry money comes with certain obligations, regardless of whether they are written into formal contracts. In other 1995 results, Campbell and his colleagues found that almost half of life-sciences faculty members in the United States received gifts from industry, including biomaterials, equipment, discretionary funds, and student support. More than 40% of those receiving discretionary funds felt that they should use them only for purposes agreed to by the company, and a quarter felt an obligation to test company products. A fifth expected the company to review articles before publication, and another 14% expected the company to claim ownership of patentable results.

Whether or not there is pressure, it is in researchers' interests to please the company. Even though "there is no contract, no agreement," says Frank Dellaert, a robotics and computer-vision researcher at the Georgia Institute of Technology in Atlanta, who has received two grants of about \$40,000 from Microsoft, "it is in my own self-interest to use the money [as proposed] to build that relationship up."

Even when there are no formal contracts, most companies check on progress regularly, and some also get involved in the research.

But "I feel the same pressure with NSF"—the U.S. National Science Foundation—"because they also expect progress and [us] to work on what they fund us for," says Balazinska, who now also has corporate grants worth \$70,000 from Microsoft and Cisco Systems.

Strings

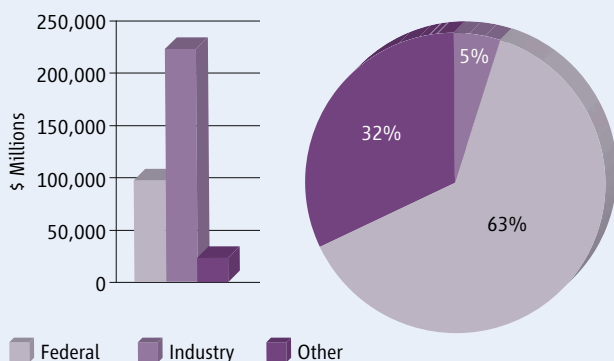
A potentially more hazardous way for academics to get corporate money is to work together with companies on projects of mutual interest, like Serra's violin synthesizer. In such collaborative agreements, academics almost always have to trade away some freedom. "Contract work is usually more specific than grant-supported research in terms of deliverables," Anderson says. "There is no question that being involved in these [collaborative] relationships is going to affect the autonomy of setting up the direction of the research. Industry can't fund people to do something that's [just] fun and interesting to them. That's one of the tradeoffs."

It's not just deciding what research to do, however. In these collaborative projects, both academia and industry contribute knowledge, effort, and resources. Both have much to gain, and to lose, so the terms and conditions of the relationship must be negotiated with care. This may mean signing away some freedom

in using the data and reporting results.

Universities, companies, governments, and professional associations all have been scratching their heads to figure out what compromises are okay. Most experts and researchers agree that accepting industry money is fine as long as academics don't compromise the academic missions of their universities. "The tipping point is when scientists' commitments to industry-funded research compromise their ability to do what their university appointments require: promote the public good through training students and pursuing research on important issues," says Anderson. "Such compromises happen when proprietary concerns get in the way of either of these responsibilities, as in delaying a student's progress toward a degree or deflecting a research program from important, broad questions to questions of little concern outside a company's specific development program."

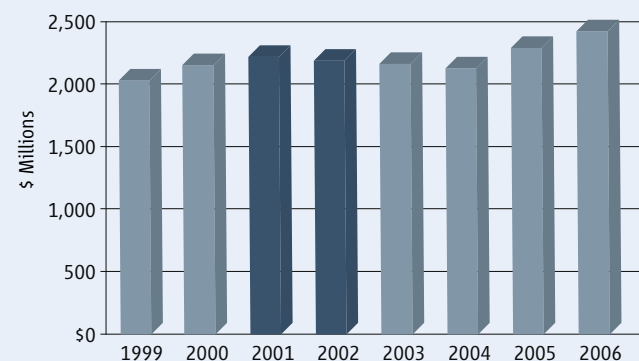
One of the most contentious issues is ownership of IP. According to the U.S. Business-Higher Education Forum, an organization of Fortune 500 CEOs, college and university presidents, and foundation leaders, an appropriate arrangement is for universities to keep IP ownership while allowing companies to commercialize innovations. A common solution is to grant the



Business Financing for Your Research

Scientists at academic institutions usually turn to government and foundations for money to do their research, and for good reason: These sources provide the bulk of the funding for academic research. But the fluctuating federal research budgets of recent years, in Europe and Japan as well as the United States, have given researchers reasons to go looking for alternative funding sources.

Business spends more money on research and development than the public and academic sectors combined (bar chart, above left). But only a small proportion of that investment reaches academic researchers. In 2006, according to figures compiled by the U.S. National Science Foundation, industry spent \$2.4 billion at U.S. academic insti-



tutions. That's just 5% of total funding for academic research (pie chart, above), but it's still a nice chunk of change.

Speaking of change: That number hasn't changed much over time, in either direction. Businesses have roughly maintained their levels of academic research support (in current dollars) since 1999, declining only slightly in the years of slow economic growth that followed the 2001 recession (bar chart, above right). Level funding (or a small decline) doesn't sound impressive in an era when researchers aspire to doubling research budgets, but steady private-sector funding can provide a small cushion given the ups and downs in government support for science.

—ALAN KOTOK

Alan Kotok is managing editor of *Science Careers*.

company exclusive or nonexclusive licensing rights or the right of first refusal.

Another thorny issue is data ownership and disclosure. As the Federation of American Societies for Experimental Biology (FASEB) has stated, any terms preventing publication of research results or asking for ghost authorship are unacceptable.

Companies are routinely given the option to review publications for confidential information and patentable data. In the United Kingdom, the government has provided a set of legal contracts—the Lambert Agreements—for researchers to draw on as models for reasonable compromises with industry. Under the terms of these agreements, companies are given up to 30 days to review manuscripts. Companies may also ask academics to keep new data secret until a patent application is filed. The Lambert Agreements give companies up to 12 months for this, but the U.S. Business–Higher Education Forum recommends limiting this delay to 90 days.

Model agreements and guidelines can be very helpful, but things can go wrong. That's

one reason most universities now have business-development and technology-transfer offices; it's a good idea to get them involved in any deal as early as possible. Indeed, many institutions require professors to disclose links with industry so that they can oversee those relationships and help researchers avoid sticky situations. "You have to go through university lawyers who see that all the university's and investigators' interests are protected," as well as the integrity of science, says Elizabeth Heitman, a biomedical ethicist at Vanderbilt University in Nashville, Tennessee. According to a white paper from the National Academies' Government–University–Industry Research Roundtable, in the United States, such negotiations on average take 70 days and may last as long as several years.

If you do manage to navigate your way to a deal and produce publishable results, you have one more important obligation: Most journals require authors to disclose conflicts of interest. Campbell also recommends that researchers disclose ties with industry whenever they present their results.

Recognition and career prospects

According to the U.S. Business–Higher Education Forum, industry-funded students may take an extra 6 months to earn their Ph.D.s compared with publicly funded peers. Yet industry involvement can be an excellent door opener. Industry grants and fellowships "are probably fine as long as the student has the opportunity to choose his or her dissertation [topic] and conduct the research independently of the company and publish their results," Campbell says. Academic supervisors must assure that the projects are Ph.D.-worthy, that graduation and publications aren't delayed unreasonably, and that students are aware of the potential pitfalls.

Experience working with industry may be especially beneficial for trainees who expect to work in industry. Postdocs seeking jobs in academia have less space to maneuver. They cannot afford to have their publication record put on hold and should make sure any delays are offset by a constant stream of papers from other, publicly funded projects. "If you are an early-career researcher and too much into patenting rather than publishing, your

Finding Industry Funding

Most collaborations between companies and academic researchers are initiated by industry scientists looking for specific technologies or expertise, notes Anthony Boccanfuso, executive director of the Washington, D.C.-based University–Industry Demonstration Partnership (UIDP), a consortium aimed at improving collaboration between universities and industry. But that doesn't mean university researchers have to sit and wait for the phone to ring. If you are looking for industry funding, it helps to be proactive.

Exploit ready-made opportunities

In many cases, researchers interested in private-sector funding need look no further than their own campuses. Many research institutions already host industry-funded programs. At their most ambitious, these programs are massive, multicenter research consortia that recruit dozens or even hundreds of industry partners. Albany NanoTech, a multibillion-dollar research complex affiliated with the College of Nanoscale Science and Engineering at the University at Albany in New York state, involves more than 250 corporations, many of which provide major funding for university faculty members.

Many universities also administer industry-funded grant programs on a smaller scale. ConocoPhillips, for example, recently announced that it will give \$22.5 million over 8 years to the multidisciplinary biorenewable fuels research program at Iowa State University in Ames. The grant will fund about 10 faculty members in its first year.

Tune in to industry needs

Establishing new university–industry alliances requires some legwork. If you have a good sense of which companies might profit from your work, search those companies' Web sites for faculty fellowships. Also look for competitive requests for proposals (RFPs), a mechanism a small but grow-



Take the lead. Anthony Boccanfuso (*left*) urges academic scientists to make their case to industry, as Karen Wooley of Washington University in St. Louis has done.

ing number of companies use to provide grants to academic researchers.

For the past 2 years, a response to an RFP has netted two unrestricted grants of about \$40,000 for computer scientist Frank Dellaert, who studies robotics and computer vision at the Georgia Institute of Technology in Atlanta, to develop new online three-dimensional mapping technologies for Microsoft's Virtual Earth. Dellaert says the RFP application process is far less cumbersome than some federal grant applications, which require technical proposals 15 to 60 pages long. "With Microsoft, you write one page of text; there is no budget, just a back-of-the-envelope calculation. It's extremely painless."

In addition to developing formal RFP procedures, many large corporations—DuPont and Pfizer, for example—have adopted an R&D model known as open innovation, forming corporate "technology connectors" to fund external scientists and entrepreneurs to work on tightly defined problems. A consumer-products company, for example, might use this

progress toward an academic career can be compromised,” Anderson says.

Industry collaborations may look like gold stars on the CVs of young professors. “Usually it’s only the scientists who are doing really well in academic circles” that industry seeks out for collaborations, Anderson says. Yet, industry grants are perceived as “not peer-reviewed and not as prestigious” as public funding, Campbell says, so they may not be given as much weight in the tenure process. Furthermore, the strings attached—obstacles to publishing and presenting your work and limitations on your ability to interact with other researchers—can hold back your progress toward tenure and promotion.

This is a price Serra is willing to pay—and has. “I am not a full professor,” he says. If he had worked less with industry and more with traditional funding sources, “I would have been a long time ago.” But the opportunity to work with a company like Yamaha at the interface of science, engineering, and music justifies the sacrifice. “I lose certain things; I gain others,” he says.

—ELISABETH PAIN

Elisabeth Pain is a contributing editor for *Science Careers*.



Additional Resources

A roundup of the issues in the Business–Higher Education Forum’s *Working Together, Creating Knowledge* report

www.acenet.edu/bookstore/pdf/working-together.pdf

Practical guidance from the U.S. University–Industry Demonstration Partnership

www.uidp.org/

The European Commission’s IPR Helpdesk

www.ipr-helpdesk.org/controlador/principal?seccion=principal&len=en

Responsible Partnering in Europe

www.responsible-partnering.org/

The U.K. Lambert Agreements

www.innovation.gov.uk/lambertagreements/

The FASEB tool kit for managing financial relationships with industry

opa.faseb.org/pages/advocacy/coi/About.html

The Committee on Publication Ethics guidelines on good publication and the code of conduct

www.publicationethics.org.uk/guidelines

mechanism to request proposals for a polymer that adheres to polyester surfaces. Open innovation is largely focused on technology transfer or intellectual-property licensing, but opportunities for funding academic research also exist.

Some companies also work through intermediaries, such as the companies NineSigma and InnoCentive, which broadcast their clients’ R&D requests to scientists, engineers, and entrepreneurs around the world who have opted into the companies’ proprietary “solution provider” networks.

Build relationships

Too often, academic researchers seeking corporate support for their work try to convince industry scientists that what they do is great science, notes Michael Amiridis, a chemical engineer and dean of the college of engineering and computing at the University of South Carolina, Columbia. Instead, he says, “try to understand what the problem is that industry is trying to solve and show what you can bring to the table. It takes cultivation, and it takes time.”

“A lot of people think, ‘Oh, companies have lots of money; let’s get some of that money,’” says chemist Karen Wooley of Washington University in St. Louis, Missouri, who studies nanometer-scale polymer particles and has received funding from a number of industry sources. “That’s a naive point of view. We can’t expect handouts or open-ended gifts. It has to be a friendship based on mutual respect, and there has to be an indication that the company is going to get something out of it.”

Making personal connections is “far and away the best way to get a deal done,” says David Rosen, executive director in worldwide business development at Pfizer. “Getting a champion inside the company to want your technology breaks through a lot of barriers. If somebody inside the company is pulling while you’re pushing, stuff tends to get done a lot faster and a lot more effectively.”

The trick is knowing where to start. Many academic researchers feel disconnected from the private sector, and targeting companies “cold” is “a

tortured path because companies’ internal structures aren’t usually transparent to the public,” notes Boccanfuso.

But finding industry scientists with compatible interests isn’t as hard or as mysterious as it might seem. Industry researchers graduate from the same doctoral programs that generate academic researchers, belong to the same scientific societies, attend the same conferences, publish in the same journals, and register with the same patent office. That means that with some detective work, you can figure out who they are.

At professional conferences, take advantage of opportunities to meet industry scientists. “I see the tendency of academics to cluster among themselves at these meetings,” says Amiridis. “I don’t do this. I go out and look at the nametags. Talk to people. You need to sell yourself.” While you’re chatting, nurture these fledgling relationships by inviting your new industry friend to give a seminar in your department. Return the honor by offering to give a seminar to the company’s scientists.

Make yourself as visible as possible. Set up a profile on the professional networking site LinkedIn and indicate in your contact settings that you’re interested in consulting offers, job inquiries, and expertise requests. Make full use of university databases that detail researchers’ interests, suggests cognitive psychologist Dennis Proffitt of the University of Virginia, Charlottesville, who has received funding from several industry sources.

University research administrators can also be rainmakers, says Don Gerhart, associate vice president for research and innovation at the University of Oregon, Eugene. Many research administrators, he notes, monitor opportunities for research partnerships with the private sector and are happy to help guide faculty members toward industry collaborations.

When all else fails, pick up the phone and make cold calls. “Be bold and invite yourself in, even if it’s going to cost you some money,” says Amiridis. “Maybe three out of four times it won’t lead to anything, but the one time that it does, it can easily pay for the other times.”

—SIRI CARPENTER

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