FIAP November 1995 Newsletter

INSIDE

But Is It Physics?

Abbas Ourmazd and Len Feldman

Physics produces a "can make anything, can fix anything" attitude. This is of immense value in industry, where work evolves with market needs, cuts across disciplines, and is focused on delivering useable solutions. But is this "Physics?"

Our friend Larry Jackel heads a department developing new internet services. This was far from his mind when he joined Bell Labs in 1975, with a fresh Ph.D. in physics from Cornell. Yet, his successful career is not atypical of what a physicist in industry might hope to emulate. It has taken him from work on Josephson junctions, to nanofabrication, to mesoscopic physics, to machine learning, and now to the hot internet. At the same time, he has managed R, R&D, and mainly development (r&D) projects, with business considerations assuming an increasingly important role.

In many countries, the changes from R to R&D to r&D+business preceded the peace dividend. Australia, for example, set a target of 30% "external earnings" for CSIRO, its premier 7000-member system of "national labs" in 1989. Chris Walsh was at the time a leading authority on length metrology and standards. With a background in plasmas, optics and metrology, he set out to guide his department of metrology and optics experts into doing work that industry was willing to pay for. Today, Walsh's department delivers turn-key optical profiling solutions to companies around the world, with clients ranging from the mining industry to the Chinese Mint.

Walsh has created an entire "food chain", which both protects and leverages the physics-based expertise of the department.

Jackel and Walsh are two examples of the many ways in which physicists have evolved successfully in non-academic environments, taking advantage of the diversity offered by an industrial setting. For more recent entries into the job market, the adjustment is more telescoped. But as Jackel points out, more useful than any specific course, physics produces a "can make anything, can fix anything" attitude. This is of immense value in industry, where work evolves with market needs, cuts across disciplines, and is focused on delivering useable solutions. But is this "Physics?"

By launching FIAP, the APS has moved beyond such questions of definition, because ultimately, they do not matter. It has recognized the evolving nature of science and technology, and the central role that can be played by physicists in this evolution. The fact that the World-Wide Web was started at CERN should not be regarded as a little-known accident, but an example of how physicists can and do spawn new fields, sometimes with revolutionary effects. The question is not whether Jackel and Walsh are doing physics. Rather, in a world where industry is less willing to offer physicists time to evolve, we must ask how to continue launching Jackels and Walshes. We need to create conditions that allow the next generation to begin its evolution within the physics community, before entering the job market.

By forming FIAP, extending the bylaws governing election to Fellowship criteria to include industrial work, and through a number of other initiatives, the APS has made a strong move in this direction. This has elicited enthusiastic support from the APS membership. Three months after its launch, FIAP became APS' largest Forum. A request for volunteers to help FIAP generated 500 offers. The challenge before us all is to transform this fund of goodwill into services that help physicists apply physics for the good of society, which ultimately supports us. FIAP looks forward to your help in this exciting endeavor.

Abbas Ourmazd is head of the Microphysics Research Department at Bell Labs, Director, Institute for Semiconductor Physics, Frankfurt (Oder), and Professor, Technical University of Brandenburg-Cottbus, Germany. Len Feldman is head of the Silicon Materials Research Department at Bell Labs.

Changing Work Styles Of Physicists In Industry

Leonard J. Brillson, Martin A. Abkowitz and Surendar Jeyadev

Changes in the U.S. R&D environment have had a big impact on the physics community as fewer, if any, traditional industry research openings remain available. Yet many scientists are not yet aware of the fundamental nature of this change and the ingredients needed for success in this new environment. At the 1995 APS March Meeting, The Forum on Industrial and Applied Physics and the Committee on Applications in Physics sponsored a symposium on "Changing Roles of Physicists in Industry." This symposium emphasized that industry still has opportunities for physicists, but these are not necessarily within the traditional employment framework they are trained for. A second symposium, this one sponsored by the Council/Committee on Applied Physics, illustrated novel applications of physics training.

A number of themes emerged from the FIAP panel's presentations. One was that industry is moving from being technology-driven to being market-driven, and thus will measure the value of research by its contribution to marketable products. Panelist Bill Brinkman from AT&T Bell Labs talked about the role of an executive technical officer, whose job is using the technical talent in his organization to create new business value for the corporation. Another industry trend is from long-range R&D to low-cost, short-range activities; Bill Shreve of Hewlett Packard Central R&D spoke on the nature of exploratory research in a company known for rapid product development The panelists observed that specialization is becoming secondary to the ability to move among disciplines, and Galen Fisher from General Motors described the challenges to performing research and development in a multidisciplinary environment. Xerox's Tom Orlowski described the crossfunctional team work processes now used to develop new technology more effectively and the skills each researcher needs to be successful. Finally, Carl Nelson from the Small Business Innovation Research (SBIR) agency spoke about a new government approach to create opportunities for a new breed of entrepeneurial scientist.

CAP's symposium on "Visualization and Simulation" drew an overflow crowd to hear Joe Letteri of Industrial Light and Magic, Steve Bryson from the NASA Ames Research Center, Tom Wickham-Jones, Wolfram Research, and LLNL's James Belak. Their presentations illustrated some of the unconventional activities to which physics and mathematics training is being applied.

To visualize dinosaurs for Jurassic Park, Letteri described a process which began with dynamic studies of large extant animals like elephants to capture realistic skeletal and muscular motion. Scientific input was combined with empirical optimization to simulate skin textures and such subtle secondary effects as the visual impact of impinging rain. Speaking on advanced simulation techniques to visualize complex time-varying fluid flows, Bryson described a specialized data glove and helmet through which specific portions of the data space are selected and displayed. Wickham-Jones presented recent advances in the development of an "active mathematical document" in which are embedded animations based on mathematical equations in text form. Belak showed dramatic videos depicting surface wear on the nanometer scale, the result of visualization of molecular dynamics of systems containing up to 5×10^8 atoms!

These two APS symposia highlight the versatility of physics training and the breadth of potential occupations open to the imaginative physicist. As such non-traditional careers become the norm in a changing world, physics students will find the "powerful generalist capability" of a physics education increasingly valuable.

For an extended summary of the FIAP symposium, contact FIAP's Arlene Modeste [Modeste@APS.ORG] or the author [Len_Brillson@wb.xerox.com]

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Rethinking the Ph.D.

John A. Armstrong

The upheaval in East-West relations and the rapid transformation of global markets have stimulated a fundamental reexamination of U.S. science and technology activities. So far, however, there has been little serious reassessment of the underlying assumptions, expectations, and requirements of Ph.D. programs in science and areas of engineering closely allied to science. In my view, it is time for such a reassessment.

With the end of the Cold War and the escalation of international economic competition, the rationale for funding nonbiomedical scientific research in universities has changed. Increased attention must be paid to research in the so-called strategic areas - those that are most likely to help the nation achieve its economic or environmental goals. The subject is a delicate one: There is widespread and justifiable nervousness about how to balance the vigorous pursuit of strategic basic research and applied research with the equally vigorous pursuit of other areas of research, which are driven almost solely by the internal excitement and logic of the field.

World leadership in basic research is neither necessary nor sufficient for our society to achieve its economic and environmental goals. Successful R&D represents less than 5 percent of the process by which wealth and jobs are created. Countries that perform the remaining 95 percent of the process well can succeed in reaching their goals without having to become world leaders in research. Nonetheless, a nation that does the nonresearch aspects of the job competitively and leads in basic research may expect to gain a comparative advantage. Since the United States currently enjoys world leadership in many areas of research, we ought to be careful to preserve that advantage.

At the same time, however, we need to address deficiencies in our national performance in the 95 percent of wealth-creation that is not R&D. We must consider what role scientists and engineers can play in "downstream" activities. Many people with skills outside of science are needed,to

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be sure. But there is much that is not R&D that can and should be done by people with scientific training. I say "can" because much of this work is done best by those with technical background and understanding: and I say "should" because societies that do bring the skills of scientists to bear on this work will have an advantage in world competition. They will get more for their investment, and sooner, than countries whose scientists and engineers play less frequent and prominent roles beyond the laboratory.

The need for reassessment is underscored by a shift in the balance between the importance of research results and the value of the Ph.D. training through which those results are obtained. In many fields of physical science and engineering - such as electronics, telecommunications, and computing - the importance of academic research results is decreasing. Not only is the bulk of new technical knowledge in such fields derived from industrial R&D, but the competitive advantage conferred by new knowledge is declining. Over the next decade or so, the training students experience in many areas of science is likely to be more valuable than the research results they produce in their course of study.

In rethinking science and engineering Ph.D. programs, the mission agencies that support academic research need to reassert that they have an explicit mission to foster graduate technical education as well as to support research that produces results of interest to them. University faculty must look at the uses, nontraditional as well as traditional, to which a Ph.D. may be put. In short, they should ask the question: What is a science or engineering Ph.D. for?

The Ph.D. Paradox

In many respects, Ph.D. programs in science and engineering are in good shape. The technical sophistication of new graduates is often breathtaking. They are still the best vehicles in the world for transfer of new insights and new ways of doing things.

And yet there are serious problems as well, problems I came to see over many years of hiring and managing new Ph.D.'s. The training of new Ph.D.'s is too narrow intellectually, too campus-centered, and too long. Furthermore, many new Ph.D.'s have much too narrow a set of personal and career expectations. Most do not know what it is they know that is of most value. They think that what they know is how to solve certain highly technical and specialized problems, such as building and using molecular beam apparatus, designing micro-processors, or writing high-speed networking protocols. Of course, what they actually know is how to formulate questions and partially answer them, starting from powerfuland fundamental points of view.

This is part of what one might call "the Ph.D. paradox." To earn a Ph.D. in science or engineering research, a young person is expected to make an original contribution to science or engineering science. It is expected that the graduate student will ask a narrowly defined set of questions and, within that narrow region, think and/or experiment deeply. He or she must learn how to pose a problem, decide what data or experiments are required to solve it, obtain that data, analyze it critically, draw conclusions, and then defend those conclusions vigorously. In the process, the student has discovered how to acquire new skills, including the ability to understand and use just about any form of applied mathematics. The student has, in a word, learned how to learn at a very sophisticated level.

The paradox, of course, is that in the course of deep, specialized inquiry, one acquires an intellectual armamentarium that may be of great general utility. The training of the scientific or engineering specialist in fact provides much of what might be termed training for the advanced technical generalist. It is a further paradox that many new graduates do not seem to value this powerful generalist capability - perhaps because their professors seldom value it either.

Training for Ph.D.'s in the sciences is best described as apprenticeship. Graduate students attach themselves early and tightly to individual professors. The attachment is so tight in most cases that the apprentices identify more strongly with the research group of their professor than they do with the department or even the university of which they are a member. Despite mechanisms to ensure common standards, the nature of the apprenticeship depends strongly on the personality and intellectual style of the individual professor. Candidates for Ph.D.'s in different groups often have very different overall experiences and have to meet differing de facto standards. On balance, the flexibility of this system has served us well.

The acceptance of overspecialization, however, often has unfortunate consequences for the new engineer's or scientist's self-image. Overspecialization can result in a lack of both perspective and of self-confidence; new Ph.D.'s often feel ill-prepared to venture outside their specialty to explore jobs in development, manufacturing, or technical management. The burden of overspecialization is compounded by their often total lack of work experience outside the university and by a culture that often suggests to them in not-so-subtle ways that becoming like their professor should be their goal and measure of success.

It is true, of course, that as individuals and as members of their discipline, professors take pride in the fact that many of their students turn out to have highly successful careers in business management or in government service or as teachers and professors in nonresearch institutions. But this is all thought to be irrelevant to the graduate curriculum. The curriculum is still characterized overwhelmingly by what is necessary for the training of future research faculty members. The presumption seems to be that the apprenticeship process designed for the traditional science Ph.D. would do as well in fitting graduates for employment in these nontraditional roles. Although these nontraditional uses of the Ph.D. have been around for a long time, their importance to society and to society's support for the scientific research enterprise requires that they be taken into account in new ways.

One factor that contributes to overspecialization is the lack of serious requirements for scientific and technical breadth in the typical graduate curriculum. Another is the fact that there is little or no encouragement, and a lot of implicit discouragement, for the graduate student who wants to spend time off campus in a setting where technical knowledge is actually used. There is, in short, almost no value assigned to technical breadth or to real-world experience as an essential part of Ph.D. training.

In addition, the typical Ph.D. takes too long to acquire - six years on average. The length of time it takes to obtain a Ph.D. is only in part due to course requirements and faculty pressure to get more research results for a thesis. It is also due to the students' comfort with graduate-student life and their anxiety about what it will be like in the outside world. By permitting such long stays, universities and funding agencies effectively underwrite this combination of comfort and anxiety.

Shortening the average duration of graduate study by a year to 18 months will lower the cost to the nation of training a given number of young scientists and engineers, provided there is not an off-setting increase in the number of Ph.D. candidates admitted. And it will put graduates at less of a disadvantage with respect to their contemporaries, who are years ahead in gaining experience and seniority in the workplace. Experience in the world of technical work will also lower the typical graduate student's anxiety about finding a job and starting a career.

Building in Breadth

In my view, radical change is not required to improve the overall effectiveness of Ph.D.-level training. Training by apprenticeship under the direction of an expert really does work: It provides both new research and training simultaneously. If the method were not available, we would hail its invention as a breakthrough. At the same time, whatever changes need to be made will leave the system perfectly capable of producing new generations of researchers and new cadres of professors.

First, with the cooperation of the funding agencies, universities should increase the proportion of students supported by fellowships or internships during their first two years. This will mitigate the pressure on graduate students to join a professor's research group in the first year and thus start specializing too soon. Fellowship support for the first two years would also make it possible for students to spend summers away from the university in work settings that could give them needed perspective, experience, self-confidence, and contacts.

In addition, increased use of fellowships would introduce a new form of competition among the science departments of research universities. Word would get around among graduate students as to which math or physics departments are best coupled to the nonacademic world of scientific employment.

Second, graduate programs should reintroduce the requirement of a minor field of concentration in order to let students broaden their preparation for careers outside the research university - or college or high-school teaching, for example - as well as allowing for greater scientific breadth. Such possibilities are open to Ph.D. students now, but students are strongly discouraged from using them. And rare indeed is the faculty that draws attention to the ways in which broader education can be achieved.

Some faculty members and administrators may argue that such requirements are not necessary in the "best" research universities, since their graduates are "real scientists." I believe this is wrong. Leading departments should aspire to train not only the best research scientists but also the best scientists for service in other fields, whether in business, in government, or in university leadership.

Third, we should explicitly encourage Ph.D. students to spend time in "user environments" outside the university as part of their apprenticeship - perhaps in internships analogous to the co-op programs often used by undergraduate and master's degree students. The ultimate aim of these internships should be to provide technical work experience that is as unlike academic research as possible. So, for example, internships in manufacturing are preferable to internships in a corporate research lab.

Industry can play a valuable role in planning for these internships. The willingness of firms to take on graduate students will depend on factors that vary by company, by industry, and with the economic climate. Small firms and start-up companies have the most to gain by such arrangements, and the most to give students in the way of broad perspective. Many graduate schools are surrounded by small companies started from university science and engineering programs.

Fourth, universities, the funding agencies, and industry should work together to create opportunities for members of the science faculty - not just graduate students - to expand their understanding of how science is put to work in the world outside the university. Far too little value is placed on faculty members' professional experience in the outside world. Fellowships, consulting sabbaticals, and other incentives could enable professors to spend time away from the university in settings where science is used. Conversely, more companies should allow key technical people to spend time in universities as adjunct faculty. The improved perspective that will be gained on both sides will be more than enough to offset the substantial effort needed to initiate such arrangements.

Society is poised between a heightened expectation of what scientists and engineers can do, on the one hand, and an uneasy sense that our contributions to society have been largely overrated, on the other. Under these circumstances, it behooves us all - academic faculties, funding agencies, and the many types of institutions that employ scientists - to take the improvement of graduate science and engineering education very seriously.

Industry can and should do more to contribute to graduate technical education, but detailed suggestions for change must come from within the academic community. The best that we in industry can do is offer to help where appropriate and to transmit our sense of the urgency of the need to rethink Ph.D. training. We feel this urgency because the students at issue are of enormous importance to our own future, and because we believe that society's continued support of the academic science and engineering research establishment depends on that establishment doing a better job of equipping our most highly trained citizens to use their skills and knowledge to achieve society's goals.

John A. Armstrong recently retired as IBM vice president, science and technology. This article is adapted from "What Is a Science or Engineering Ph.D. for?", a lecture delivered at the Massachusetts Institute of Technology on Nov. 10, 1993, and originally appeared in Issues in Science and Technology.

Instead of cloning their facul ies, science and engineering graduate schools should be preparing their students for a variety of possible roles.

FIAP ELECTION RESULTS

The newly elected officers of FIAP are:

Chair: Abbas Ourmazd

Chair-Elect: Leonard Brillson

Vice-Chair: L. Craig Davis

Secretary-Treasurer: Harry Atwater

APS Councillor: Matt Richter

Members-at-Large:
Ray Baughman (three years)
Margaret Weiler (three years)
Andy Sessler (two years)
Dave Fraser (two years)
Don Sandstrom (one year)
Neville Connell (one year)

FIAP Program Plans

H.F. Dylla

The Forum on Industrial and Applied Physics with the help of the group which spawned the forum-the APS Committee of Applied Physics-is planning a series of sponsored and co sponsored technical sessions at the 1996 APS meetings and AIP member society conferences. The FIAP Program Committee's goal is to identify topics and speakers that show the breadth of applied physics and the adaptability of physicists in non traditional career paths. Basic physics research and the ranks of academic physicists are well served by the gamut of general and topical meetings sponsored by the APS. However, it is no revelation to many physicists involved in applied research and development that many of the essential meetings on applied topics are sponsored by other societies or ad hoc topical groups. The Forum has no interest in supplanting these meetings. However, we can co-sponsor selected meetings where APS co-sponsorship is beneficial, and we can sponsor selected topics at general APS meetings which illustrate the excitement and importance of applied physics as an endeavor and a career path.

The FIAP's program plans for 1995-96 are still under discussion and we welcome input from the rapidly growing FIAP membership. We can offer the following snapshot of our preliminary program plans:

At the March 18-22 1996 General Meeting in St. Louis, FIAP will be sponsoring sessions on:

- Progress Towards an all Optical Communications Network
- Applications of Instrumentation to Biology and Biomedicine
- Industrial Use of Synchrotron Radiation
- Physics of Waste Management
- Physicists and Finance

In addition, Program Committee members are actively planning an interesting series of sessions on the evolution of the internet, the ubiquity of computers and the makings of successful products.

At the May 2-5 1996 General Meeting in Indianapolis, FIAP is planning to co-sponsor sessions on:

- Materials processing with high power electron, ion or photon beams
- Plasma processing

At the Oct. 1995 National Symposium of the American Vacuum Society in Minneapolis, FIAP will co-sponsor sessions on:

- Flat Panel Displays
- Magnetic Surfaces, Interfaces and Nanostructures
- Plasma, Vacuum and Manufacturing Science and Technology

The FIAP Program Committee is engaging in discussions with the organizers of other applied physics conferences and is eager to discuss opportunities for collaboration or co-sponsorship. Anyone desiring more information on the 1995-96 FIAP program plans can contact Fred Dylla at dylla@cebaf.gov or Craig Davis at Ldavis@smail.srl.ford.com.

H. F. Dylla is with CEBAF. L. Craig Davis is with Ford Research Labs. The authors are FIAP Program Committee Co-Chairs.

FIAP Calls For Nominations for APS Fellowships

Abbas Ourmazd

The Forum on Industrial and Applied Physics (FIAP) calls for nominations from industrial and applied physicists for Fellowships of The APS. Such Fellowships are awarded to highly distinguished members for advances in knowledge through original research and publications, or significant and innovative contributions in the application of physics to science and technology, or significant contributions to the teaching of physics, or service and participation in the activities of the Society.

Nominations for Fellowship through FIAP should be signed by two members of the Society, and reach the APS Honors Program by January 15, 1996. FIAP's Fellowships Committee, consisting of FIAP officers, reviews the nominations referred to FIAP, and recommends a shortlist for approval by the FIAP Executive Committee. The FIAP-sponsored list is forwarded to APS Council for final approval in the Fall.

Nominations may be made at any time during the year, but only those received by January 15 will be considered for action in the following year. Nomination forms are available from the Americal Physical Society, One Physics Ellipse, College Park, MD 20740-3844, Tel: 301-209-3268, or by email from honors@aps.org, or from the Honors and Award section of the APS Home Page on the Worldwide Web. Completed forms should be returned to the APS Executive Officer at the same address, ATTN: Fellowships Program. Nominations on which no favorable action is taken are generally reconsidered the following year. Further supporting material may be submitted prior to the next deadline for nominations.

The list of newly elected Fellows appears in the March issue of the APS NEWS the following year, and the names of the Fellows elected through FIAP are read at the FIAP business meeting immediately following their election.

NOTES FROM SILICON VALLEY:

A BRIEF LOOK AT THE SEMICONDUCTOR INDUSTRY

Matt Richter

Current developments in the semiconductor industry demonstrate that there is always a need for materials and process development. In a way, the worldwide demand for cheap Nintendo, cellular phones and faster processors has created a niche for people who understand materials, materials modeling and equipment design.

> Everyone in the industry, from the raw material suppliers to test equipment manufacturers to actual chip makers, is stretched to capacity. Equipment sales grew 28% in 1993, 40% in 1994, and 1995 projections are being revised upward from 28% in January to 35% in July. Over the last five years, the compound annual growth rate was 14.3%.

Tantalum capacitors can be hard to come by, and a worldwide DRAM shortage has prompted quite a large number of fab starts. For instance, six of ten new or refurbished foundries in Taiwan scheduled to come on line by the end of 1997 will be dedicated to memory production, with another two devoting part of their capacity to memory. While the rest of the world is not leaning quite so heavily on memory production, new fab sites are popping up all over. Seventy-seven new fab lines will come on line in 1995-6, 26 in the US, 23 in Japan, 9 in Europe and 19 in Asia and the Pacific. But even this explosive increase in capacity will barely keep pace with demand. The semiconductor industry will need at least two years just to meet current demand, but failure to anticipate future demand soon leads to bankruptcy in Silicon Valley.

Smaller. Faster. Cheaper. 0.5 and 0.35 um lithography is cutting edge. 0.25 um feature sizes are scheduled to come on line during 1998. The trickle-down effect is already being felt. At Semicon/West, in July, many companies were talking to their equipment suppliers about the need for both higher accuracy and precision, both of which are needed for the move to deep UV lithography, without taking a hit in wafer throughput.

Another potential cost savings would be a move to 300mm (12") wafers. This move alone would double the number of devices per wafer. So far only two players are committed to this move. Motorola and Samsung both plan to have 300mm fabs on-line by 1998, with Motorola planning a simultaneous move to deep UV 0.25um technology. While this may seem like a rather small step, the shrinkage in dimensional size combined with the increase in wafer diameter implies an order of magnitude increase in positional accuracy. And this requirement must be held for every dimension-critical piece of equipment in the entire fabrication process, a very expensive proposition involving many independent companies.

Higher clock speeds imply faster electronics. Decreasing sizes place additional demands on equipment, some of which has yet to be designed. And as sizes decrease, surface geometry and contamination also have a much greater effect on electronics performance. In this relentless pursuit, the semiconductor industry depends on continuing innovations from its industrial physicists.

Matt Richter is the Senior Applications Engineer at Hypervision Inc., a producer of specialized semiconductor inspection microscopes. All of the information presented in this column has been gathered from the Electronic News, Electronic Buyers Guide and Channel, a publication of SEMI.

The Industrial Physicist

After one issue, The Industrial Physicist has already attracted around 10,000 subscription requests, according to the editor/associate publisher, Ken McNaughton, at the American Institute of Physics. The business plan called for 12,000 subscriptions after two issues. Work is well under way on the second issue, which will be mailed at the end of November. This issue is said to include an even more interesting mix of technical and career type articles, as well as a salary survey of physicists in industry. Manuscripts are already being lined up for proposed quarterly issues in 1996. If you would like to submit an article, contact Ken at the address below and ask for author guidelines. Feature articles are 1,000 and 2,000 words long. If you haven't already sent in the subscription form from the July issue, there is still time. If you need a copy of the magazine, send your request to Ken at The Industrial Physicist, One Physics Ellipse, College Park, MD 20740-3843; tel. 301-209-3051; fax. 301-209-0842; e-mail tip@aip.org.

Industrial and Applied Physics Speakers List

Barrett Ripin

The APS, under the auspices of FIAP and CAP (Committee on Applications of Physics), have produced a compilation of over 115 physicists who are available to speak on industrial and applied physics topics at schools, universities, and in other public forums. It is intended to help academia and industry form closer ties. There are over 200 titles listed in the booklet. Speakers listed in this first edition of the Industrial and Applied Physics Speakers List (IAPSL) were solicited from the first 500 physicists who indicated on their application to FIAP that they wanted to play an active role. About half the speakers work in industry, one-quarter in universities, and the remainder in government laboratories and other venues. The listings are grouped by state, field and type of employer. Booklets are being distributed to most colleges, universities, and other organizations free of charge. Those interested in obtaining a copy please contact The American Physical Society, One Physics Ellipse, College Park, MD 20740-3844 to the attention of Ms. Arlene Modeste or email a request to modeste@aps.org. The IAPSL compilation will also be posted on the APS Home Page [http://www.aps.org] under the FIAP button. Those interested in volunteering for next year's edition can do so by filling out the enrollment form at http://aps.org/units/fiap/cslfiap.html or by emailing Arlene Modeste at modeste@aps.org with your full address.

Barrett Ripin is APS Associate Executive Officer.

JOBS, NETWORKING, PRIZES

FIAP is planning to launch initiatives aimed at new job opportunities, industrial and applied physicist networking, as well as establishment of new prizes. FIAP welcomes your suggestions regarding these or other potential initiatives. Members may also volunteer to serve on working groups directed toward these goals, as well as the Newsletter Steering Committee, by contacting:

Prof. Harry Atwater
Attn: FIAP
MS #128-95
246 Watson Lab
Pasadena, CA 91125
Fax: (818) 795 7258
email:
Haa@daedalus.caltech.edu

FIAP Home Page Is Now Available

Matt Richter

A wealth of information of interest to FIAP members is posted on the World Wide Web under the FIAP Home Page. Here you can find FIAP Newsletters, announcements of upcoming events such as symposia and related meetings, resources like the industrial speakers list, and links to other useful Home Pages, as well as user postings. Official information about FIAP and APS, such as Bylaws, officers, meeting minutes, and forum registration will be readily accessible on the Home Page. The FIAP Home Page can be accessed through the APS Home Page [http://www.aps.org] by clicking the Forums button and then the FIAP button. The information posted on the FIAP Home Page is accessible to members and nonmembers alike, as is most of the information under the rest of the extensive APS Home Page. The only information restricted to APS members at the moment is the on-line member directory and on-line APS News. Right now, user postings are limited to additions to the upcoming calendar of events, requests for and offers of help, brief items/articles of interest to the FIAP members and links to other WEB sites. User postings and suggestions for additional postings or services should be forwarded to Matthew Richter at email address [mattr@ix.netcom.com].

Tips for Nomination:

The selection process is highly competitive. The total number of APS Fellows who may be elected in a given year is limited to one half of one percent of the total APS membership. Successful nominees generally have ten or more years of professional experience beyond the Ph.D. Election reflects sustained contributions to the field, rather than a single (albeit brilliant) piece of work.

It is important to ensure that the nominations are well documented. A complete publication list, and lists of important invited talks, awards, committee service and organization of conferences are highly desirable. Reprints of papers are generally not helpful. However, detailed statements discussing which of the candidate's achievements are "exceptional contributions" can be very useful, particularly when they orginate from authorities in the field. The two-line statement on the standard APS nomination form is not adequate, unless the nominee is of outstanding stature.