

CSWP Gazette

The Newsletter of the Committee on the Status of Women in Physics of the American Physical Society

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Letter from the Editor: The Fading Neanderthal

Bruce J. West, Mathematics Division, US Army Research Office, Research Triangle Park, NC



Bruce West

In this letter I thought it would be appropriate to make a few comments on one way to understand complex phenomena in the social arena. This perhaps overreaches my position as Guest Editor, but I thought it might be interesting for the reader to see how unconscious mathematical models may contribute to our understanding of social issues, such as the teaching of physics and making decisions on the promotion of colleagues. Of course, a number of books have been written about these ideas - books for the research expert, books for the informed teacher, books for the struggling graduate student and books for the intelligent lay person. Different authors stress different characteristics of complex phenomena, from the erratic data collected by social researchers to the fluctuations generated by deterministic equations used to model such systems. Authors have painted with broad-brush strokes, indicating only the panorama that these concepts reveal to us, whereas others have sketched with painstaking detail the structure of such phenomena and have greatly enriched those that could follow the arguments. In this letter I do not have either the space or the inclination to do either,

so I restrict my comments to a few judiciously chosen examples of the applications of these ideas.

It seems quite remarkable that it was over thirty years ago that, as a graduate student, I sat in a seminar room at the University of Rochester and listened to Benoit Mandelbrot talk about why the night sky was not uniformly illuminated (Olber's paradox) and how income is distributed in western societies as an inverse power law (Pareto's Law). At the time these were quite exotic topics for physics colloquia. It would be more than ten years before he (Mandelbrot) coined the word fractal to take cognizance of the fact that there is a large class of natural and social phenomena that traditional statistical physics is not equipped to describe, much less to explain. In the intervening years there has been a blossoming literature on fractal random processes with inverse power-law spectra and distributions, characteristic of long-time memory, and the applications of these ideas to phenomena in the physical, social and life sciences.

So what does all this have to do with our first example, the teaching of physics?

We have all been subjected to the policy that classroom grades ought to be allocated according to a scheme based on the Law of Errors with the Normal distribution of

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CSWP Events at the APS March Meeting in Indianapolis

Barbara Jones, IBM Almaden Research Center

CSWP will be an active presence at the upcoming March meeting, with several events planned, some traditional for the Committee and some new. All those with an interest in the issues of Women in Physics are encouraged to attend.

Sunday, March 17 – Workshop on Survival Skills

A half-day workshop on Survival Skills for Successful Women Physicists will take place on Sunday, March 17, in Capitol Ballroom III of the Westin Hotel. The work-

shop will cover such issues as effective communication and networking, negotiation, leadership, advancement in organizations, and more. **Pre-registration is strongly recommended.** Fee: \$60. Information on the program, speakers, and registration are at (see article on "Taking Control of Your Career, page 3)

Sunday, March 17 – COM/CSWP Reception

CSWP and the Committee on Minorities (COM) will co-host their yearly reception on Sunday March 17, from

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The Fading Neanderthal, continued

Gauss. In fact, most of the policies, if not philosophies, of modern education are based on this misapplication of the Normal distribution: a certain fraction of the students in a class get As and Fs, a greater fraction receive Bs and Ds, and the bulk of the students get a C. One does not escape the tyranny of predetermined fractions until graduate school, where if one does not get at least a B, s/he is counseled on a possible career change.

There is, of course, no *a priori* reason why everyone taking a course, who has absolute criteria for mastery of the material, can not receive an A. The competition that arises in classes is often attributed to male testosterone, when in fact, if one is looking for someone or something to blame, it is the restriction in the number of top slots in the class that promotes the competition. Treating students as if they were independent entities, all struggling for the top grade, as one does with a Gaussian model, is, in fact, a self-fulfilling prophecy of human behavior. On the other hand, working with students and promoting their interactions with one another enhances their interdependence, facilitates collaboration and promotes a 'less masculine' model of education. The interdependence of individuals in both science and the learning of science suggest a different way of thinking about complex social interactions. So let us construct such a model in the context of a second example.

Our second example of the social application of scaling ideas has to do with recognition and advancement in the workplace. I have often heard it said that a woman has to work twice as hard and be twice as smart to receive half the pay of a man in the same position. I might question the quantitative aspect of such statements, but their qualitative nature is certainly true. But is the truth of such statements a consequence of some latent ill will between the sexes, or is it perhaps something subtler? I think that where it exists today, such apparent prejudice often has to do with the indirect influence of scaling. So let me explain why I don't think this is just another silly idea.

Let us examine the distribution of achievement and consider the mechanism to explain why such distributions have long tails. A complex task is a multiplicative, rather than an additive process, which is to say that an achievement requires the successful completion of a number of separate tasks, the failure of any one of which would lead to the failure of the project. A familiar example of a complex process, or achievement, is the publication of a scientific paper [1,2]. A partial list of those abilities that might be important of the publication of a paper is: 1) ability to think up a good problem; 2) ability to work on the problem; 3) ability to recognize a worthwhile result; 4) ability to make a decision as to when to stop and write up the results; 5) ability to write adequately; 6) ability to profit from constructive criticism; 7) determination to submit paper to a journal and 8) willingness to answer referee's objections. If we associated a probability with each of these abilities, then to some level of approximation, the overall probability of publishing a

paper would be the product of the eight probabilities. The distribution of successful publications would therefore be Gaussian in the logarithm of the probabilities, that is, it would be a lognormal distribution. A lognormal distribution has an inverse power-law tail.

So what does this have to do with promotions in the workplace?

Assume that a position has become available and a short list of candidates has been compiled. Now suppose that there are eight criteria that are being considered in the evaluation of a group of candidates all with ostensibly the same level of achievement. Using the above argument on the multiplicative nature of complex processes, we see that if each of the criteria's probabilities for an individual is changed by a factor ϵ , then that person's total probability of being promoted is changed by ϵ^8 . Small changes in specific attributes can result in large changes in one's career. For example, if in our example each attribute is 6% smaller than that of another candidate, the overall chance of getting the promotion relative to the other candidate is reduced by 40%. Thus, small changes in each of the criteria can have devastating effects on one's chances for promotion. On the other hand, a 50% change in any one factor can change the probable outcome by 50%. In an additive Gaussian process the number of criteria would dilute such a 50% change, but this is not the case in multiplicative processes.

The model of the distribution of achievements is not a Gaussian additive situation, where a strong prejudiced individual can oppose a promotion and bully others on the committee into going along with him/her. This is a more subtle, multiplicative situation, where each rumor, innuendo and slur detracts in a significant way from a person's potential being fully recognized.

As in physics, such simple models are rarely the complete story, but if they are faithfully constructed they often capture the essential features of the phenomena we are attempting to understand. I think that scaling and multiplicative processes explain more of the nature of prejudice in today's complex workplace than the more traditional picture of the Neanderthal, with his knuckles dragging on the floor, making arbitrary decisions about the futures of our wives and daughters, and yes, even our husbands and sons. This all too familiar caricature of the dominating male is fading from the scientific scene and with programs such as those supported by CSWP, we can accelerate this process. What the multiplicative model suggests is that the price of equality, like that of liberty, is eternal vigilance.

1. E.W. Montroll and W.W. Badger, *Introduction to the Quantitative Aspects of Social Phenomena*, Gordon and Breach, New York (1974).
2. B.J. West and W. Deering, *The Lure of Modern Science: Fractal Thinking*, Studies of Nonlinear Phenomena in Life Sciences Vol. 3, World Scientific, Singapore (1995).

Taking Control of Your Career—March Workshop on the Survival Skills for Women Physicists

Dongqi Li, Materials Science Division, Argonne National Laboratory

“Be twice as good” is often the advice young women physicists get from their caring, yet realistic mentors. Indeed, it is not always easy to survive, much less thrive, in this traditionally male-dominated field. It can become even more frustrating when love for physics, hard work, and good technical skills are not enough for a successful career. It is a reality that every successful man or woman has to pick up on the unspoken rules, such as how to strategically plan their career, to negotiate, to get funding, to gain visibility, etc. These strategies

are garnered from various mentors along their career paths. This process poses another problem: with so few women in physics, it may not be trivial to find a female role model or mentor from whom to learn. Research shows that a woman behaving in the same manner as a man may not be received as well, so female role models are doubly important. In addition, many women face the challenges of balancing career and family. How can we be intelligent, strong and savvy in order to take care of ourselves?

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APS March Meeting in Indianapolis, continued

6:00-8:00 pm in Congress I and II of the Westin Hotel. Committee newsletters and other publications will be available. This is an excellent opportunity to socialize and network. The reception is open to all with an interest in women and minorities in physics.

Monday, March 18 - CSWP/FIAP Networking Breakfast

CSWP and FIAP will sponsor their annual networking breakfast on Monday, March 18, 2002 from 7:00 9:00 am in the State Room (lobby level) of the Westin Hotel. Roberta Gleiter, CEO of the Global Institute for Technology and Engineering (GIFTE) will give a short talk on “Looking to the Future – Where are Tomorrow’s Scientists Coming From?”. Pre-registration is strongly recommended! Cost: \$15 (\$5 for students) Complete details are at <http://www.aps.org/educ/cswp/breakreg.html>

Tuesday, March 19 – MGM Award Winners Panel Discussion and Reception

CSWP will sponsor a special panel discussion to honor the 15 past winners of the Maria Goeppert Meyers

Award, including the 2002 winner, Deborah Jin. The event will be held on Tuesday, March 19 in the Cameral Room of the Westin Hotel from 3:30-4:30 pm. Following the discussion, there will be a reception with coffee/tea and light refreshments.

Wednesday, March 20 – CSWP/FIP Invited Symposium: IUPAP Report

An Invited Symposium Session cosponsored by CSWP and the Forum on International Physics will take place Wednesday March 20 at 2:30 pm in the Wabash 1 room of the Convention Center. Featured will be a report on the IUPAP International Conference on Women in Physics to be held shortly before the March meeting, March 7-9, at UNESCO headquarters in Paris. The APS will sponsor a delegation of both senior and junior participants to this meeting. The speakers of the APS March meeting invited symposium will be the APS delegation chair Meg Urry of Yale University; Beverly Karplus Hartline of Argonne National Laboratory; Roman Czujko of the American Institute of Physics; and a junior representative of the delegation.

APS March Meeting in Indianapolis

Order your FREE copy of the “Celebrate Women in Physics” poster!

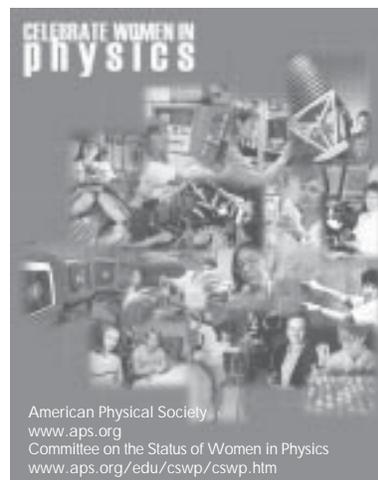
Simply return this form to APS and receive a free copy of this full-color poster. Single copies are free of charge, please call 301-209-3231 for information on bulk orders.

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CSWP has initiated a workshop “Survival Skills for Women Physicists” to be held at the American Physical Society’s March 2002 Meeting

Taking Control of Your Career, continued

In an attempt to address these issues, CSWP has initiated a workshop “Survival Skills for Women Physicists” to be held at the American Physical Society’s March 2002 Meeting. This will be an informational workshop mainly aimed at technically competent women physicists who seek advice and training concerning additional skills in navigating the waters of today’s research world. Such women include faculty members in universities, researchers in industry and government labs, and aspiring postdocs and graduate students. The half-day workshop will feature a mixture of respected professional and highly successful women physicists and cover such issues as establishing scientific identity, raising research funds, balancing career and family, effective communication and networking, leadership, building visibility / power, and more. The trainer, Dr. Sandra Shullman, will provide an interactive session on leadership and related gender issues, where the participants will learn the various skills not only from the lecture but also through discussions, role-plays, etc.

We are fortunate to have a group of highly successful physicists as the speakers as well as the professional trainer, Dr. Shullman, who is a Fellow of the American Psychological Association. The physicists represent several generations and are from a diverse set of environments, including university, industrial and government labs, and funding agencies. Mildred Dresselhaus is a well-known MIT Professor who has held many prestigious positions, such as the President of American Physical Society and the American Association for the Advancement of Science, Treasurer of the National Academy of Science, and the Director of the Office of Science at DOE. She is convinced that “additional skills and strategies are helpful for enhancing the careers of women” and will discuss this topic from her personal perspectives. Kristl Hathaway has led a dual-career as both a condensed matter theorist / scientific manager and as a well-respected funding agent. Drawing from her experiences from both sides of the funding game, as well as on extensive input from her colleagues in other agencies, she will offer some practical, no-nonsense advice on issues from how to interact with funding agents to “do’s and don’ts” for an irresistible proposal. Barbara Jones is the youngest among the speakers,

and already impressively accomplished. She will offer her observations and suggestions on work/life balance. She has been very active in the cause of women in physics and is currently the chair of CSWP. Beverly Hartline is currently the Deputy Lab Director of Argonne National Laboratory and has previously served on many high-profile management positions at Los Alamos National Lab, the White House Office of Science and Technology Policy, the Jefferson National Accelerator Facility, etc. She will discuss how to gain visibility and power in order to advance professionally. Sandra Shullman is a nationally known organizational consultant who has written and presented extensively on the topics of performance management, career development, management of self-esteem and motivation, and diversity management. She will discuss issues for women in leadership roles in a scientific setting. For more details, please check the speaker profiles and their abstracts at <http://www.aps.org/educ/cswp/index.html>.

So far, there has been a strong response for such a workshop. According to a survey conducted on the WIPHYS (Women-in-Physics) listserv, many people consider such a workshop “overdue” and indicated the subjects that are of most interest to them. The workshop will try to address as many of these topics as possible. Since this will be the first workshop of this kind, we will conduct another short survey at the end of the workshop to provide guidance for future events.

The workshop will be followed by the COM/CSWP reception. This will be a great opportunity for the participants and speakers to mingle and further discuss the issues raised at the workshop. No matter if you will attend the workshop or not, you’re welcome to come and share your own experiences, life stories, and career tips/secrets with fellow women physicists and their male friends /supporters. Or simply relax, enjoy the refreshments, and do some networking!

The workshop and the reception are open to both women and men. Details at <http://www.aps.org/educ/cswp/index.html>

CSWP Plans Variety of Events at the APS April Meeting

Cha-Mei Tang, CreatvMicroTech, Inc.

CSWP is sponsoring an invited speaker session on “Planetary Science” on 11:20 am – 1:45 pm, Sunday, 21 April 2002, at the April Meeting at Albuquerque, NM. The session will consist of four outstanding speakers covering various aspects of research and discovery. The Session will be chaired by Virginia Trimble of University of California, Irvine. The speakers and the titles of their talks are:

- “Discovery of Planets,” by Debra Fischer, University of California, Berkeley

- “The Protean Magnetospheres of the Solar System,” by Margaret Kivelson, University of California, Los Angeles
- “Dynamics of Planetary Systems,” by Renu Malhotra, University of Arizona
- “Jupiter’s Galilean Satellites,” by Melissa McGrath, Space Telescope Science Institute

The room is available for 30 minutes after the invited talks for everyone to meet the speakers.

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CSWP Plans Variety of Events at the APS April Meeting, continued

CSWP and the Committee on Minorities (COM) will co-host a dessert reception on Sunday evening, April 21, from 8:00-9:30 pm. Desserts (and wine) will be served – this is a wonderful opportunity to socialize and network with your peers! Please join us in the Hyatt Hotel's Enchantment A Room. The reception is open to all with an interest in matters pertaining to minorities and women in physics.

Other events include a networking breakfast on Monday, April 22, from 7:00-9:00 am. Our featured speaker will be Meg Urry, chair of the US delegation to the IUPAP International Conference on Women in Physics, held March 7-9, 2002 in Paris. She will speak on "Increasing Women's Participation in Physics Worldwide". Following her talk, there will be a chance for informal discussion and networking. The cost is \$15 (\$5 for students).

Pre-registration is strongly encouraged, however you need not be registered for the APS meeting to attend this event. Both men and women are welcome to attend. You may register at <http://www.aps.org/educ/cswp/apr-breakreg.html>

This meeting at Albuquerque, April 20-23, 2002, is a joint meeting between American Physical Society and High Energy Astrophysics Division (HEAD) of American Astrophysical Society covering the topics of Astrophysics, few-body systems, gravitation, new precision measurement methods, nuclear physics, particle and fields, tests of physics laws, radiation sources, accelerators and storage rings, beam physics, accelerator systems, plasma physics, physics education, undergraduate research and history of physics.

Deborah Jin Receives 2002 Maria Goeppert-Mayer Award; Panel of Winners Planned for APS March Meeting

Sue Otwell, APS Staff



Deborah Jin of NIST is the recipient of the 2002 Maria Goeppert-Mayer Award for her innovative realization and exploration of a novel quantum system, the degenerate Fermi atomic gas, and the scientific promise portended by her pioneering work.

The award is given annually to recognize and enhance outstanding achievement by a woman physicist in the early years of her career, and to provide opportunities for her to present these achievements to others through public lectures in the spirit of Maria Goeppert-Mayer.

To honor the 15th Anniversary of the Maria Goeppert Mayer Award, CSWP will sponsor a special panel discussion on March 19 at the APS Annual Meeting in Indianapolis to honor the past winners of award. Deborah Jin will join a panel of previous winners including Judith Young (the first winner), Laura Green (1994), Ellen Williams (1990), Cherry Murray (1989) and Bonny Schumaker (1988). A reception will follow the discussion.

Information is available at <http://www.aps.org/meet/MAR02/special.htm1#6>.

The MGM award consists of \$2,500 plus a \$4,000 travel allowance to provide opportunities for the recipient to give lectures in her field of physics at four institutions and at the meeting of the Society at which the award is bestowed, plus a certificate citing the contributions made by the recipient. The award was established through sponsorship in 1985 by the General Electric Foundation (now the GE Fund).

Maria Goeppert-Mayer received the Nobel Prize in Physics in 1963 for her discovery of the magic numbers and their explanation in terms of a nuclear shell model with strong spin-orbit coupling. She shared the prize with J.H.D. Jensen. She was the first person to investigate the theoretical basis of nuclear pairing which plays an important role in the shell model of the atomic nucleus.

A complete listing of all MGM Award Winners may be found on the APS Prizes and Awards website at <http://www.aps.org/praw/mgm/index.html>

CSWP will sponsor a special panel discussion on March 19 at the APS Annual Meeting

Have you moved? Changed jobs? Changed fields? Take the time now to update your name/address/qualifications on the Roster of Women in Physics (this database also serves as the Gazette mailing list). See pages 12-13.

Trying to reach more women and minority candidates for job openings in your department or institution? Consider a search of the [APS Roster of Women and Minorities in Physics](http://www.aps.org/educ/roster.html). (see www.aps.org/educ/roster.html)



Twenty-six women are among the 190 new Fellows of the American Physical Society.

APS Names Women Fellows for 2001

Sue Otwell, APS Staff

Twenty-six women are among the 190 new Fellows of the American Physical Society. This is an increase of 100% over 2000, when 13 women were named to Fellowship.

The APS Fellowship Program was created to recognize members who may have made advances in knowledge through original research and publication or made significant and innovative contributions in the application of physics to science and technology. They may also have made significant contributions to the teaching of physics or service and participation in the activities of the Society. Each year, no more than one-half of one percent of the then current membership of the Society are recognized by their peers for election to the status of Fellow in the American Physical Society.

The 2001 Women Fellows are:

Rama Bansil

Boston University

For her important contributions to phase transition kinetics, probe diffusion and chemical reactions in gels and applications of gelation in biological systems.

Elizabeth J. Beise

University of Maryland

For contributions to and leadership in electroweak interaction studies, especially for measurements of parity violation in polarized electron-nucleon elastic scattering elucidating the role of strange quarks and the anapole structure.

Patricia R. Burchat

Stanford University

For her contributions to the understanding of heavy quark physics, particularly in semileptonic weak decays, in mixing of neutral D and B mesons, and in CP violation.

Mirjam Cvetič

University of Pennsylvania

For her work in a wide range of topics in supergravity and string theory, from non-perturbative gravitational effects such as black holes and domain walls to their phenomenological consequences.

Jill P. Dahlburg

Naval Research Laboratory

For making pioneering advances in computational plasma physics, development of a full 3-D radiative transport hydrodynamic code, and the understanding of inertial confinement physics, especially Rayleigh-Taylor instability and ablation physics.

Charlotte Elster

Ohio University

For her significant contributions to the understanding of the nucleon-nucleon interaction and its applications in few-body systems and nuclear reactions.

Laurie A. Fathe

George Mason University

For serving as an example of a Civic Scientist - for ongoing work in promoting state and national policy that supports science and science education, and for her efforts to inspire and teach other scientists to be effective in the policy world.

Lisbeth Dagmar Gronlund

Union of Concerned Scientists

In recognition of her many important contributions to arms control, including work on missile defense, missile capabilities and the nuclear fuel cycle as it relates to proliferation, made possible by her ability to analyze technical issues and by her communication skills.

Naomi J. Halas

Rice University

For the development of new types of nanoparticles with unique optical properties and applications, and ground breaking studies of molecular modification of scanning probe microscope tip properties.

Julia W.P. Hsu

Bell Labs/Lucent Technologies

For pioneering work in applying scanning probe microscopy techniques to elucidate the nanometer scale electronic and optical properties of novel materials, in particular the physics related to defects.

Anne Myers Kelley

Kansas State University

For outstanding and innovative work in Raman spectroscopy.

Margaret Galland Kivelson

University of California, Los Angeles

For numerous pioneering contributions connecting fundamental principles of plasma physics to spacecraft observations ranging from geomagnetic field line resonances to the discovery of the magnetic topology of Jupiter's moons.

Christine Labaune

Ecole Polytechnique

For the most comprehensive study of parametric instabilities in laser produced plasmas, using novel and advanced applications of Thomson Scattering.

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APS Names Women Fellows for 2001, continued

Nancy Makri

University of Illinois

For developing novel real time path integral methods and decisively quantifying how condensed phase environments affect quantum barrier crossing and biological charge transfer.

Laurie Elizabeth McNeil

University of North Carolina

For numerous contributions towards improving the climate for women in physics, including extending the Committee on the Status of Women in Physics Academic Site. Visit Program and performing an extensive report on the dual-career couple problem.

Margaret Mary Murnane

University of Colorado

For her major contributions to the optical physics and technology of the generation of ultrashort pulses of optical and x-ray radiation.

Angela Villela Olinto

University of Chicago

For her many contributions to the advancement of particle astrophysics, from inflation to ultra-high-energy cosmic rays.

Monica Olvera de la Cruz

Northwestern University

For her contributions to the understanding of polyelectrolytes, block copolymers and multicomponent polymer blends.

Regina Abby Rameika

Fermi National Accelerator Laboratory

For her crucial role in establishing the first direct evidence for the tau neutrino.

Shang-Fen Ren

Illinois State University

For her contributions to theoretical understanding of low-dimensional semiconductor systems, especially the vibrational properties in semiconductor superlattices, quantum wires, and quantum dots as well as for her many contributions promoting international scientific collaborations, such as through the National Science Foundation's Research Experience for Undergraduates program with East Asia.

Julia Elizabeth Rice

IBM Almaden Research Center

For pioneering the development of efficient algorithms for the analytic derivative method with electron correlation, and for the calculation of frequency dependent polarizabilities with accuracy comparable to experiment.

Natalie Ann Roe

Lawrence Berkeley National Laboratory

For her leadership in the design and construction of the BaBar silicon vertex detector, and her studies of BB mixing, oscillations, and CP violation in B meson decays.

Frances Mary Ross

IBM T. J. Watson Research Center

For her pioneering contributions to in-situ studies of materials processes in the electron microscope.

Tamar Seideman

National Research Council

For creative work in theoretical molecular physics, including coherent control of internal and external molecular degrees of freedom of molecules, control of surface reactions using an Scanning Tunneling Microscope, and time-resolved photoelectron.

Antoinette Jane Taylor

Los Alamos National Laboratory

For pioneering developments of ultrafast optoelectric techniques and their use in understanding dynamical processes in electronic materials and devices.

Bing Zhou

University of Michigan

For outstanding contributions and leadership in the development, construction, and exploitation of complex detectors in fundamental particle physics experiments.

A complete listing of all the 2001 Fellows of the APS, both men and women, can be found at <http://www.aps.org/fellowship/>. There are also instructions on how to nominate a individual for fellowship, forms, and deadlines for nomination.

Things Your Professor Should Have Told You: Learning from 30 Years of Experiences about Gaining More Power for Women Scientists

Alice S. Huang, PhD, Senior Councilor for External Relations and Faculty Associate in Biology at the California Institute of Technology. She received her training in microbiology at Wellesley College and Johns Hopkins University.

As recently as thirty years ago, when the Association for Women in Science (AWIS) was founded, it was not uncommon for male professors to ask female graduate students "Why do you want to go into science when

Let me share with you what I have learned in my career as an academic scientist and university administrator about power and empowerment

Things Your Professor Should Have Told You, continued

you can be at home raising beautiful babies?" A lot has changed since then. Over 60% of married women and 78% of women with children now work outside the home. Many jobs previously thought to be unsuitable for women are now available to them. Women visibly participate in every part of society. Yet recent surveys show some disturbing trends. A larger percentage of women entered the science professions in the 1970s than in the 1990s. Barriers to women's career advancement, although they are more subtle, still exist. How can we remove those barriers? How can we encourage young women to enter the sciences and become successful science professionals?

Gaining Opportunity, Equality, and Power

In 1995, then Secretary of State Madeleine Albright said in Beijing that women will contribute fully when they have opportunity, equality, and power. In reviewing changes over the past thirty years, we can say that women have largely gained equal access to opportunity. But equality and power still elude many. Without full equality and effective power, we cannot contribute fully to society. More importantly, we cannot better our own lives or those of our daughters. To gain full equality, we must gain power. Therefore, power should become our next focus.

How do we gain power? It is not a disgrace to want power and to wield power, especially when it is for a common good.

Because external power is not readily within the reach of many women, we need to focus on self-empowerment. This is within our control but, unfortunately, it is not often done. Much can be gained if we practice self-empowerment as well as empowerment of one another. Self-empowerment means celebrating and supporting women as well as sharing our experiences and educating each other about what leads to success. This empowers each other and ourselves.

Let me share with you what I have learned in my career as an academic scientist and university administrator about power and empowerment. It is important to understand power and how to gain power in our own right.

Learning the Academic Structure

In higher education, as in many professions, individuals pass through specific gates in the natural progression of careers. Each of these gates is marked by a title change and an increase in salary corresponding to years of experience. We are familiar with the academic ladder beginning with postdoctoral fellow, promotion to assistant professor, to associate professor, and so on. If one chooses not to follow this well-defined path, there are other routes to take, but it means getting off the academic ladder. Defining a new career structure can be rewarding, but often getting off the ladder results in difficulties and disillusionment. For example, a research associate position is commonly sold as a job with less stress and more freedom to pursue research. In truth, there may be less stress, but

freedom is illusory. Proceeding along this path provides a chance to gain research experience but not commensurate increases in salary or public recognition. As the years go by, increased professional isolation takes its toll; despite maturity and experience, reversing this projection and getting back on the academic ladder is extremely difficult.

Another reason to leave the usual career path is financial. Taking a lucrative but subordinate position with a faculty member at the university can be a compelling incentive to jump off the academic ladder. However, the once lucrative salary quickly reaches a ceiling. Further advancement is limited and job stability depends on the tenure of the faculty boss at the institution.

Leaving academia and joining another structured environment, such as the biotechnology industry, offers financial rewards and unusual challenges. However, once this route is taken, proprietary information may limit publication and getting back on the academic ladder becomes more difficult if not impossible.

Although there may be good reasons for taking these different paths, it is important to be fully aware of the consequences of such choices, especially when they are made early in one's career. In the academic culture, falling off the academic ladder means leaving the usual path to advancement, security, and recognition. More importantly, these other routes do not lead to power within the academic structure.

Starting Off Right

Once the structure of the organization is understood, it is necessary to be successful within that organization. To do so means fulfilling the expectations of the organization. The first independent position, usually as an assistant professor, is very demanding. It becomes necessary to teach, attract, and mentor trainees; to set up a laboratory; and to organize independent research. This is a crucial time for concentrating on one's career. Personal issues that intrude at this time may be detrimental.

Unlike students and postdoctorates, an assistant professor cannot accomplish her responsibilities alone. No individual, no matter how capable, can do all that is needed at this stage as a loner. Building support, seeking out advisors, and forming meaningful relationships with colleagues are essential at this time in your career. There are many ways to accomplish this.

First, other women, especially secretaries and technicians, are there to offer support and they can be tremendously helpful, especially if they think they are respected in return and are appreciated for their contributions. Delegate, delegate, delegate! Delegating routine, time-consuming tasks is necessary, no matter how well or easily you can do them yourself.

Support can come from peers as well. All too often, we compete against other assistant professors, because in some institutions only a few survive the promotion pro-

Things Your Professor Should Have Told You, continued

cess. A way around this competition is to seek out those at the same stage in other departments or institutions, particularly women or individuals who share similar scientific interests. We all need reality checks with peers so that we can judge whether a situation that is new to us is unusual or expected. Peer support can also provide relief in fulfilling obligations during emergencies.

Support from mentors and senior professors must be cultivated, especially support of thesis and postdoctoral advisors. It is not enough, however, to maintain cordial contact with these mentors. Seek out scientific leaders and those whom you respect in your chosen field. Make sure your department chair and your dean know something about your work. It never hurts to send a packet of your reprints to all these individuals. Even better, send them preprints because those are more likely to be read. Ask them for advice and help when you need them. Most senior faculty are flattered when asked and are more than willing to help.

Avoid a Common Pitfall

It is likely that male professors will become your mentors, so it is important to be aware that the ugly head of sexual tensions may turn up when you least expect it. Such topics are usually not discussed because they are difficult. A good mentor is likely to become a friend. Be business-like and professional at all times. Sometimes it will be up to you to defuse tensions and make the men around you feel comfortable. Remember that you can be friends with your mentor's wife and show that you are not a threat. Jealousy on her part will inhibit mentoring by her husband. Any sexual innuendo can diminish your credibility and ruin your career. Be very careful! These are sensitive issues and it is better to be aware of them than to turn a blind eye.

A Word About Extracurricular Activities

Assistant professors before tenure need to use extracurricular time judiciously. Do not volunteer to be on any more committees than you have to. Gauge the value of the committee in terms of career networking and advancement. It may be difficult to say no to some of these committees, but at this point in your career it is necessary to stay focused on the academic ladder. Pick visible, leadership roles within the institution as well as those that will enhance your national scientific reputation.

Join professional organizations and volunteer for leadership positions in those organizations. Professional gatherings provide a wealth of informal information beyond the scientific exchanges and permit you to compare your situation with many others. Information gleaned at such meetings will make you more effective on the job and the colleagues you meet may become part of your national support team.

Be a Good Mentor

Learn how to be an effective mentor yourself. Do not be more critical of female students than of male students. Do not be a perfectionist; many women scientists set extraor-

dinarily high standards for themselves and for others. Promoting the best in your students will ensure a stream of trainees. However, being critical of their every effort will frustrate and turn off students. Learn to compliment your trainees and junior women faculty. Compliment them not only in their presence but also in their absence. You will empower them by these actions.

Make Your Work Visible, Known, and Valuable

Do not imagine that by simply working hard and being an excellent scientist you will be recognized and promoted automatically. Publishing is essential. So do not delay publication. Your work is your life's blood and communicating it whenever and wherever you have the chance will advance your career.

Even that is usually not enough. Helping someone else get a job done may be gratifying, but unless you lay some claim for what you have done, the credit will go to others. Some self-promotion is necessary. Seek credit. Make oral or written annual reports letting department chairs or deans know about your accomplishments and awards. Ask for promotions and salary increases. Do not expect them to come your way unless your organization has a transparent policy applied evenly to everyone. Notify the school paper or magazine when an award comes your way so that it will be properly publicized. Ask supportive colleagues to make award nominations or to suggest you for better positions.

Finally, do not ignore the finances of everything you do. Money talks. Bringing in an extra grant or an umbrella grant will empower you. Obtain a fair salary that reflects your importance in the organization. If your salary provides extra income, try contributing to your own institution or to philanthropy and see the added benefits such actions will bring. In fact, understanding and using the power of money is one of the first steps to rising into powerful management positions.

Once in Power . . .

Although some power will accrue at every level in academia, the power to change institutions really exists at the full professorial or administrative positions. There is a caveat. Polly Bunting, a past president of Radcliffe, said "Once you are in a position of power do not forget that you are still a woman." She was afraid that in climbing the academic ladder women would adopt the masculine culture and identify only with the male power structure. I advised that early in your career you need to focus primarily on the imperatives of the academic ladder, but once in power there are many things a woman can do to help other women. Besides hiring and promoting more women, the lives of women faculty can be empowered by powerful individuals acting in the following ways:

Review compensations, start-up packages, office and laboratory spaces, and access to institutional resources every now and then to ensure equity between male and female faculty.

Your work is your life's blood and communicating it whenever and wherever you have the chance will advance your career.

Things Your Professor Should Have Told You, continued

- Provide discretionary dollars to faculty from an institutional source when special circumstances dictate the need.
- Introduce faculty to lucrative consulting activities or other extramural opportunities as appropriate.
- Make women faculty aware of such opportunities and how to qualify for them.
- Avoid overloading women faculty with teaching and committee responsibilities.
- Provide effective mentoring and timely reviews.
- Nominate women for awards and other kinds of recognition.
- Develop complete intolerance for the casual discrediting or minimizing of women's contributions and accomplishments.
- Make sure that the bar is not set higher for women than for men.
- Cooperate with other institutions to provide jobs for accompanying spouses.
- Provide a menu of benefits for all.
- Provide well-run, inexpensive daycare centers, as well as emergency childcare.

Only when more women gain and use power can we bring about real and lasting change.

This article is reprinted with the kind permission of the Association for Women in Science (AWIS). It is adapted from an article which appeared in the Spring 2001 issue of the AWIS magazine <http://www.awis.orgmagazine.html> This manuscript was presented, in part, at the Conference on Shaping a National Agenda for Women in Higher Education, University of Minnesota, March 27-29, 2000.

Equal vs. Appropriate Treatment in the Classroom: A Student's View

Patten Priestley, Physics Major, Davidson College

For me, positive comments on assignments mean more than the scores next to them.



Equality is generally accepted as a desirable characteristic in our culture. We believe if people are considered equal, they have identical opportunities and treatment. Treating men and women the same, however, has often meant treating a woman like a man. This is due to the primary domination of males and the "catching up" of

females. I believe men and women should be held to the same expectations concerning their ability and performance, but their intelligence is cultivated in a fundamentally different environment.¹ Women shouldn't have to adapt to a male-oriented teaching style. The teaching style should adapt to its new, increasingly diverse class.

Although the female/male ratio among physics students has risen, my generation is still experiencing some resistance. Here are some suggestions that would help others like myself along. Shake up your teaching style every once in a while and notice what environment is best for your students. Ask yourself exactly what motivation you are giving your class. Some students can work diligently on their own, while others need strict deadlines. Competitive and teamwork settings can affect people in extreme ways. Research has suggested that most women favor collaborative as opposed to competitive environments. Group activities can be intimidating as well, especially for someone who isn't confident in his or her

abilities.² Take note of who participates in particular class assignments and adjust the class settings so everyone is engaged. Don't be afraid to ask your students how they learn best. Each class is different from year to year and the course curriculum should reflect their particular learning styles. Your teaching style should be sensitive to the strengths and weaknesses of the students on your present roll. Make your lectures pertinent to the audience this year, not last year, or twenty years ago.

Highlight everyone's potential as often as you can. I don't think anyone could ever be sick of hearing how wonderful he or she is. A confident student is a happier person. When students do well, reward them with positive feedback rather than criticizing them less. In a physicist's terms, make your praise proportional to a student's good work as opposed to your criticism inversely proportional to success. Positively encourage everyone, whether or not they are doing well. Studies have shown that a woman's confidence level can drop independently of her actual performance. Her self-confidence is more influential than her true ability in determining her strengths.³ For me, positive comments on assignments mean more than the scores next to them. In terms of grades, emphasize that everyone's potential deserves challenges to push him or her further. Classify these as *challenges* and not tests of potential or worth. Someone once told me that grades are the measure of self-deprivation. I would rather have had practice balancing my family, close friendships, and my schoolwork, than

continued on page 11

be sent out into the world having memorized every word of a few dozen textbooks. My attitude may not be one a teacher should endorse, but it shouldn't be criticized. Be careful when you suggest that someone's priorities are wrong just because they are different from yours.

Physics is a very impersonal field. This may be a reason women are sometimes not attracted to it. Women enjoy relating to people, including teachers. It's hard to relate to angular momentum and quantum mechanics. Let your students relate to you by showing your respect for them. Show them why you do what you do and what you love about it. Learn about an individual's interests outside of your classroom. Go to sporting events or be an advisor for a student program. The more you get to know your students, the better you can teach them, the more respect they will have for you, the better they will want to do in your class, and the more comfortable they will be to ask for help.

When communicating with students individually, remember that women notice the subtleties of situations. What is coming out of your mouth may be filtered by lack of eye contact or noticeable uneasiness. Don't let this discourage you from taking time to speak with them. Women especially may need those personal connections to manage weaknesses and failures. It is hard for me to be engaged in a class taught by someone who doesn't remember my name outside of class. If I feel as if a teacher is putting his or her time into teaching *me*, as opposed to just another person at a desk, I'll want to put my time into the class. Perhaps make an assignment to connect the students' everyday lives or goals to the material. An

essay assignment would show how important writing and communication skills are to an individual and break up the problem sets a bit. Show that you are interested in students' thoughts as well as abilities and work and allow them to take a step out of their intense studies, gain perspective, and express themselves.

When I look back on my education, I feel lucky that I haven't been discouraged enough to quit pursuing a physics degree. There have been many late nights and test scores where a cloud of frustration consumes my mind and tears well up in my eyes. Friends ask why I put myself through the aggravation and often I can't come up with a satisfactory answer. Truthfully, I believe the only thing that has helped me is the faith others have shown in me. My family and friends have taught me that above all education is not about simply learning facts, but about maturing in character. My favorite teachers have taken the time to promote my academic *and* personal education. I believe that a classroom should be an environment where each individual is cultivated appropriately rather than equally.

1. Jane Butler Kahle and Judith Meece, "Research on Gender Issues in the Classroom," *Handbook of Research on Science Teaching and Learning* ed. Dorothy L. Gabel. (New York: MacMillan Library Reference, 1994) 544-550.
2. Kahle and Meece, 550.
3. Rhoda Unger and Mary Crawford, *A Feminist Psychology* (New York: McGraw Hill, 1992) 86-91.

I feel lucky that I haven't been discouraged enough to quit pursuing a physics degree

A Physics Momma

Ellen Yorke, Physicist, Memorial Sloan Kettering Cancer Center, NYC, NY

I have worked full time as a physicist since the early 60's, starting with a doctorate in theoretical solid state, followed by teaching in a small college department and subsequently switching over to medical physics in the mid 80's. As is true of many of my women colleagues, I struggled both physically and emotionally with the conflicts of raising a family and maintaining a career. Thus, I was particularly touched by a poem that the youngest of my 3 children, now an adult and NOT a physicist, wrote for my birthday. I thought that other women physicists, at an earlier phase in their lives, could take comfort in my son's words!

A Physics Momma

Robert Yorke (son of a physicist)

Every Kid should have
A Physics Momma who'll
Teach him early on
That Absolute Zero is Cool.

To be Positive about Ions
Shows that you have class,
And if it doesn't Matter
Then it has no Mass.

They'd learn that a Tachyon
Is a Particle without Style,
And Gravity can get you down
At times, once in a while.

A Kid would know to catch a Mole
Avogadro's Number's what to call.
And she'd take them Nuclear Fishin'
Or toss the Bucky Ball.

I've gone off on a Tangent
When all I want to Sine
Is that every Kid should have
A Physics Momma just like Mine.

The American Physical Society 2001-2002 Travel Grants for Women Speakers Program

The APS Committee on the Status of Women in Physics (CSWP) is pleased to announce the 2001-2002 "Travel Grants for Women Speakers" Program. This program is designed to increase the recognition of women physicists.



Purpose The program is intended to expand the opportunity for physics departments to invite women colloquium/seminar speakers who can serve as role models for women undergraduates, graduate students and faculty. The program also recognizes the scientific accomplishments and contributions of these women physicists.

Grant The program will reimburse U.S. colleges and universities for up to \$500 for travel expenses for one of two women colloquium/seminar speakers invited during the 2000-2001 academic year.

Qualifications All physics and/or science departments in the United States are encouraged to apply. Canadian and Mexican colleges and universities are also eligible, provided that the speakers they invite are currently employed by U.S. institutions. Invited women speakers should be physicists or in a closely related field, such as astronomy. Speakers should be currently in the U.S. The APS maintains the Women Speakers List which is available online at (www.aps.org/educ/women-speaker.html). However, selection of the speaker need not be limited to this list. Neither of the two speakers may be a faculty member of the host institution.

Guidelines Reimbursement is for travel and lodging expenses only. Honoraria or extraneous expenses at the colloquium itself, such as refreshments, will not be reimbursed.

Application The Travel Grants for Women Speakers Application Form (www.aps.org/educ/cswp/travelgrant.html) should be submitted to APS identifying the institution, the names of the two speakers to be invited and the possible dates of their talks. Please note that funds for the program are limited. The Travel Grants for Women Speakers Application Form should be submitted as early as possible, even if speakers and dates are tentative, or if the speakers are scheduled for the spring semester. The application form will be reviewed by APS, and the institutions will be notified of approval or rejection of their application within two weeks. Institutions whose applications have been approved will receive a Travel and Expense Report Form to submit for reimbursement.

For Further Information: *Travel Grants for Women Speakers Program*

Attn: Arlene Modeste Knowles
The American Physical Society
One Physics Ellipse • College Park, MD 20740-3844
Tel: (301) 209-3232 • Fax: (301) 209-0865 • Email: travelgrant@aps.org

Women Speakers List

The American Physical Society's Women Speakers List (WSL) is an online list of over 3,000 women physicists who are willing to give colloquium or seminar talks to various audiences. This list serves as a wonderful resource for colleges, universities, and general audiences. It has been especially useful for Colloquium chairs and those taking advantage of the Travel Grant Program for Women Speakers. To make the WSL easy to use, we have made the online version searchable by state, field of physics, or speakers' last names.

If you'd like to search the list to find a woman speaker, go to <http://www.aps.org/educ/women-speaker.html>

Interested women physicists who would like to be listed on the Women Speakers List or those who'd like to modify their existing entries can do so at <http://www.aps.org/educ/women-speaker.html/>

Women Speakers List (WSL)

Enrollment/Modification Form 2001-2002

Additions/Modifications may also be made on the Internet at www.aps.org/educ/cswp.index.html
 An online copy of the WSL is also available.

The *Women Speakers List* is compiled by The American Physical Society Committee on the Status in Physics (CSWP). The list is updated continuously online and published each summer. Comments, questions and entries should be addressed to:

Women Speakers List • APS • One Physics Ellipse • College Park, MD 20740-3844 • (301) 209-3232

To enroll or update your current entry, please fill out this form completely and return it to the address above.
 Please print clearly or type.

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Institution _____ **Telephone** _____

Address _____ **Fax** _____

_____ **Email** _____

City _____ **State** _____ **Zip Code** _____

If you have moved out of state, list previous state: _____

New Entry Modification

For which audiences are you willing to speak? (Please check all that apply)

Middle school High school General Audiences Colloquium

To register a new title, give the title as you want it to appear in the left column below. Then check the section(s) where it is to be inserted. To delete a title, indicate the title and check the appropriate box below. A limit of four total entries will be imposed. You may use additional pages if you are submitting more than four modifications. PLEASE TYPE OR PRINT LEGIBLY PAYING PARTICULAR ATTENTION TO FORMULAS. WE REGRET THAT WE ARE UNABLE TO INCLUDE ILLEGIBLE ENTRIES.

TALK TITLE	PHYSICS SUBFIELD (limit 4)
1. <input type="checkbox"/> Add this title <input type="checkbox"/> Delete this title	<input type="checkbox"/> Accelerators <input type="checkbox"/> Education (pedagogy etc.) <input type="checkbox"/> Interface/Device <input type="checkbox"/> Astrophysics <input type="checkbox"/> Environmental/Energy <input type="checkbox"/> Molec/Polymer <input type="checkbox"/> Atomic <input type="checkbox"/> Fluid <input type="checkbox"/> Nuclear/Particle <input type="checkbox"/> Biological/Medical <input type="checkbox"/> General <input type="checkbox"/> Optics/Optical <input type="checkbox"/> Chemical/Statistical <input type="checkbox"/> Geophysics <input type="checkbox"/> Plasma <input type="checkbox"/> Computational <input type="checkbox"/> History <input type="checkbox"/> Condensed Matter <input type="checkbox"/> Industrial
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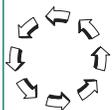
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