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Essay Review

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WOMEN IN SCIENCE: A FAIR SHAKE?

J. Scott Long (ed.), *From Scarcity to Visibility: Gender Differences in the Careers of Doctoral Scientists and Engineers* (Washington, DC: National Academy Press, 2001), 311 pp., ISBN: 0-309-05580-6

Sue Rosser, *The Science Glass Ceiling: Academic Women Scientists and the Struggle to Succeed* (New York: Routledge, 2004), 165 pp., ISBN: 0-415-94512-7

Laurel Smith-Doerr, *Women's Work: Gender Equality vs. Hierarchy in the Life Sciences* (Boulder: Lynne Rienner, 2004), 205 pp., ISBN: 1-58826-264-2

Yu Xie and Kimerlee A. Shauman, *Women in Science: Career Processes and Outcomes* (Cambridge, MA: Harvard University Press, 2003), 318 pp., ISBN: 0-67401-034-5

The under-representation of women in science in the United States of America and elsewhere, its causes and consequences, has generated considerable debate and some improvement. However, the public remarks of Harvard University President Lawrence Summers – suggesting that there may be innate differences between men and women in mathematical ability – illustrate the deeply rooted nature of the debate, as well as a misuse of genetics.[1] Summers' inference from the University's roster was that there is a 'natural' explanation for the fact that men are disproportionately represented in senior positions in academic science. His comments ignited a firestorm.[2] The influence of the Harvard presidency made his remarks a 'make or break' issue. Displacing effect into cause, he

[1] Lawrence H. Summers, 'Remarks at Conference on Diversifying the Science & Engineering Workforce', National Bureau of Economic Research, 14 January 2005, *http://www.president.harvard.edu/speeches/2005/nsaws.html*, accessed 5 May 2005.

[2] Cornelia Dean, 'For Some Girls, the Problem with Math Is That They're Good at It', *The New York Times*, 1 February 2005, Section F, 3.

saw no need to focus on the social barriers to women that have been built into seemingly neutral academic structures and processes. Had his assertions been allowed to go unchallenged, they had the potential to re-legitimate gendered practices deleterious to the advancement of women. The ensuing discussion focused on two questions: the effect of academic practices in impeding women's scientific careers, and the reliability of empirical evidence purporting to show the genetic distribution of scientific abilities by gender.

In ranking hypotheses to explain the male and female presence in elite scientific institutions, Summers put biological factors first and social issues second, despite the weight of evidence pointing to the latter.[3] While it is appropriate to consider hypotheses at various levels, it is useful to work down from social factors to genes, rather than up, in order to avoid the fallacy of reductionism. As Kaplan and Rogers point out, 'at the higher levels of complexity, behaviour involves the interaction of the whole individual with the environment and with other individuals'.[4] It may also be fruitful to ask whether biologically rooted assumptions in Summers' own profession of economics have coloured his judgement. Historically, it has been common practice for economists to infer marginalist economic principles from superficial physiological differences.[5] This tendency points to a broader problem with economic analysis when it attempts to mimic the physical sciences.[6] In so doing, it replicates an aggressive male model of scientific discourse. In this context, President Summers' twenty-first-century reprise of nineteenth-century Social Darwinism may seem disturbing. His transmogrification of social differences into genetic characteristics can only serve to legitimate the status quo and offer an excuse not only to 'blame the victim', but also to perpetuate inequity.

[3] See Virginia Valian, *Why So Slow: The Advancement of Women* (Cambridge, MA: MIT Press, 1999).

[4] Gisela Kaplan and Lesley Rogers, *Gene Worship: Moving Beyond the Nature/Nurture Debate over Genes, Brain and Gender* (New York: Other Press, 2005).

[5] Robert Proctor, *Value-Free Science? Purity and Power in Modern Knowledge* (Cambridge, MA: Harvard University Press, 1991), 81.

[6] Virginia Postrel, 'Some Economists Say the President of Harvard Talks Just Like One of Them', *The New York Times*, 24 February 2005, Section C, 2.

NATURE/NURTURE: BACK TO THE FUTURE?

In support of his explanation for the relative absence of women in the higher reaches of academic science, Summers referred to *Women in Science: Career Processes and Outcomes*. However, when interviewed by the *New York Times*, the authors rejected Summers' interpretation of their work. Indeed, they – like the other authors reviewed here – found little evidence of a gender gap in mathematical achievement, and pointed instead to organizational and cultural blockages as the primary deterrents to women in science. While Xie and Shauman confirmed earlier findings that differences between males and females in average achievement in mathematics and science are small in magnitude, they also found that this difference is higher in average science achievement, when compared to the gap between males and females in average maths achievement (p. 55). Their findings rejected the hypothesis that the under-representation of women in very high mathematical and scientific achievement during high school explains the later under-representation of women in the science and engineering professions (p. 209).

It was this aspect of their work that was seized upon by Summers, when he said: 'I looked at the Xie and Shauman paper – looked at the book, rather – looked at the evidence on the sex ratios in the top five percent of 12th graders. If you look at those – they're all over the map, depends on which test, whether it's math, or science, and so forth ... 50 percent [of] women, one woman for every two men, would be a high-end estimate from their estimates.'[7] By this statement, Summers seems to have inferred that only half as many women as men are high achievers in mathematics and science. However, he singled out one aspect of the Xie and Shauman findings, while ignoring their conclusion, namely, that 'gender differences in neither average nor high achievement in mathematics explain young men's higher likelihood of majoring in [a science/engineering] field in college' (p. 209). Further, women attain significantly better grades than men in science and mathematical coursework in high school.

Xie and Schauman nowhere suggest that biological factors play a significant role in the gender gap in science and maths. They do, however, examine a number of possible explanations, including gender differences in the biology of the brain; social influences in the school; and the socializing influences of peers, teachers, counsellors,

[7] *Ibid.*

and parents. With respect to biological factors, Xie and Schauman reviewed the literature on gender differences in spatial ability – as well as brain-scanning studies, which show that men and women utilize different regions of their brains at rest, and when performing mathematical and language tasks. They conclude that it is difficult to say whether gender differences in spatial ability and brain function are due to biological or social causes. Even if differences could be shown to be predominantly biological, Xie and Schauman believe that genetics would not be the sole or major cause of observed gender differences – hence the need to understand the influence of a range of social factors.

For neo-Social Darwinists, biological 'difference' is a product of evolution, in which women seem either to have been left behind (in the development of quantitative and spatial abilities), or to lack innate qualities and dispositions suited to science and mathematics.[8] This argument is used to rationalize the fact that there are relatively few high-achieving women scientists and engineers. However, even if men, on average, turn out to have a higher aptitude for mathematics than women, 'that would not explain why so many more women have high aptitude for mathematics than have careers requiring one', as S.L. Bem has argued. 'No matter how many subtle biological differences between the sexes there may someday prove to be, both the size and significance of those biological differences will depend, in every single instance, on the situational context in which women live their lives.'[9]

Social factors play a more important role than innate differences in shaping abilities, performance, and career outcomes. This is illustrated by the fact that, in some countries, including the United Kingdom, girls' performance exceeds that of boys at all levels of schooling.[10] In mathematics, differences in achievement that were evident just a few decades ago have been wiped out by a few simple, yet systematic, changes in teaching methods. This near parity of girls' and boys' scores has been achieved in much too short a time to permit a biological explanation.

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[8] Helena Cronin, 'The Vital Statistics: Evolution, Not Sexism, Puts Us at a Disadvantage in the Sciences', *Guardian Weekly*, 18–24 March 2005, 15.

[9] S.L. Bem, *The Lenses of Gender: Transforming the Debate on Sexual Inequality* (New Haven: Yale University Press, 1993), 20.

[10] 'ASA Weighs In on Gender and Science Careers', *Footnotes* (Newsletter of the American Sociological Association), 33 (3), (March 2005), *http://www.asanet.org/footnotes/Mar05/indexthree.html*, accessed on 5 May 2005.

Such findings are not new. For example, a study conducted by Stanford psychologists in the 1950s found that differences in problem-solving among men and women – with men turning in a superior performance – could be reduced by encouraging attitudinal changes in female students, and virtually eliminated by framing the problems differently. The researchers concluded that 'to achieve maximum intellectual orientation and performance from women students, it may be necessary to appeal to different motives in women than in men'. Invisible gender bias, incorporated into seemingly neutral testing instruments, developed by scientific psychology, produced the inequality in results, and led to second-order social inequities built upon those results. Nevertheless, just as science created some of these obstacles, so it also had the potential to tear them down, by rethinking and re-ordering an aspect of the social structure; in this instance, a psychological test. However, it is clear that experimenters worked within the terms of the social structure of their day and its definitions of the feminine role.[11]

Different cultural and structural factors interact to reduce the number and performance of women in scientific and other technical occupations. This is shown by international comparative studies, which indicate that the gender gap in science and engineering education is much less than the gap in participation in these careers.[12] There is a lower percentage of women in science occupations than in science education, a still lower percentage in the higher rungs of the occupational hierarchy,[13] and an even lower percentage of women who receive prestigious awards and fellowships. For example, a recent study in India has shown that not a single woman scientist has received the prestigious Bhatnagar Prize in the past five years.[14] Thus, gender bias in science exists at all levels, ranging from participation to recognition. The well-documented 'glass ceiling' is not biologically determined.

[11] Quoted in Committee of Women Faculty Members, 'Motivation and Education of Stanford Women Students', April 1958, Terman Papers, Stanford University Archives, Series 3 SC160, box 61, folder 2.

[12] Sandra Hanson, Maryellen Schaub, and David Baker, 'Gender Stratification in the Science Pipeline: A Comparative Analysis of Seven Countries', *Gender and Society*, X (3), (1996), 271–290.

[13] Veronica Stolte-Heiskanen (ed.), *Women in Science: Token Women or Gender Equality?* (Oxford: Berg Publishers, 1991).

[14] Indian National Science Academy, 'Science Careers for Indian Women: An Examination of Indian Women's Access to and Retention in Scientific Careers', October 2004, *http://www.insaindia.org/Scienceservice/science.htm*, accessed on 4 May 2005.

Socially Constructed Glass Ceilings

Rejecting variants of the argument that biology is destiny, these four books focus attention on social factors and critical incidents in the career paths and achievements of women scientists. Following a 'life course' approach – that is, considering how social influences over the course of a lifetime can affect a person's educational and occupational outcomes – Xie and Shauman have analysed seventeen representative American data sets. Long and his colleagues have drawn upon data from the US National Research Council's doctoral survey of US scientists (1973–1995). Smith-Doerr combines qualitative and quantitative methodologies, including a sample of six universities and a database of 3,395 PhD grant-holders created by the National Institute of General Medical Sciences. Smith-Doerr also conducted forty-seven interviews with men and women in a variety of life science settings, including biotechnology firms and universities. Rosser interviewed by e-mail 450 academic women scientists who were recipients of either a National Science Foundation Professional Opportunities for Women in Research and Education (POWRE) award, or a Clare Booth Luce Professorship. These were followed up by forty in-depth telephone interviews.

Xie and Shauman use their data to reject the supply-oriented, 'pipeline thesis': the view that, simply by encouraging additional numbers of girls and young women to pursue studies in science, engineering, and mathematics, the differences between male and female entry into scientific and technological careers and promotion to higher level positions will eventually be sharply reduced or even eliminated. They argue instead that it is the interplay of supply and demand (including male discriminatory practices and structural barriers) that inhibits recruitment and advancement. In terms of education and career, they find that women have not succeeded as well as men, despite significant advances in translating educational attainment into occupational achievement. Women science and engineering graduates are about 25% less likely than their male counterparts to work in occupations for which they were trained (p. 116). Xie and Shauman argue that a further increase in educational participation – a recommendation of the National Research Council's report – will not by itself narrow the gap. However, the picture is complex. While the representation of women among young science and engineering workers is lower among those who hold only bachelors' degrees, the situation of doctoral degree holders is reversed. This suggests that women with higher degrees are able to make greater use of their human capital (p. 135).

In relation to career outcomes, Xie and Shauman focus upon a few critical aspects of gender inequality, including the 'productivity puzzle'. They claim to have identified the 'personal characteristics, structural positions, and resources that are conducive to publications' (pp. 191–192). Thus, productive scientists peak early in their careers; full professors are more productive than academics of lower rank; research universities publish more than colleges; and a move to a more prestigious institution enhances productivity. They also find that women and men have differential access to superior positions, resources, and institutions (for example, females are concentrated more in teaching colleges than in research universities). When such structural differences are taken into account, the research productivity of female scientists is found to be as high as their male counterparts (p. 193).

Even elite universities are now recognizing that they are partly responsible for women's relative under-performance. As William Kirby, Dean of Harvard's Faculty of Arts and Sciences, acknowledged on 1 March 2005, in an emailed 'Letter to Alumnae and Alumni':

> The FAS is similar to its peer institutions. We share, and not to our glory, records of less than stellar achievement in recruiting, supporting, and promoting women faculty. Academia has its own long history of discrimination, complacency, and even well meaning, but insufficiently effective efforts at genuine change. The institutional temptation for self-reproduction in faculty hiring is strong.

Still, Xie and Shauman find that the gap in productivity between men and women has closed in recent years, possibly owing to a redistribution of resources. This suggests that sex differences in research performance are not immutable, and that female productivity can rise as a result of improved access to key resources. Dean Kirby, for example, was able to point to the increased recruitment of women to non-tenured (but not as yet tenured) positions at Harvard.

In the study of women's career achievements, the impact of marriage and motherhood has been well researched. Xie and Shauman reject the hypothesis that dual-career marriages affect women more adversely than men, but accept that motherhood limits women's scientific ambitions much more than fatherhood limits male aspirations. Men have a much higher rate of mobility than women when their children are young (p. 175). Having children also affects migration, geographic mobility, and the search for better career opportunities. Becoming a mother may delay the attainment of a doctorate, and can negatively affect prospects for tenure and promotion.

On the basis of similar findings, Scott Long and his colleagues conclude that, although overt discrimination against women in science has effectively ended, covert discrimination continues. Only after carefully controlling for the many differences between men and women do the authors infer a residual category of discriminatory behaviour. For example, women are more likely to be in positions of lower status and lower pay. Men are more likely to be tenured, especially at research universities. Women are expected to meet higher standards for promotion at these schools. American academia is thus a world ordered on the principle of 'separate and unequal'. For example, women tend to be offered teaching assistantships, while men are made research assistants. The latter opens the possibility of a closer relationship with a mentor, and a clearer path to employment in a research university.

Despite the fact that women are entering science in larger numbers, many of them are also leaving. As Seymour and Hewitt have shown, one reason why female students are deterred from pursuing science and engineering to the level of their female teachers at liberal arts colleges and research universities is that their role-models – worn down by the obstacles they have encountered in male-dominated environments – are changing careers themselves.[15]

Nevertheless, the National Research Council report continues to advocate the Sisyphean strategy of encouraging yet more women to enter science. In a sense, this supply side recommendation is reminiscent of the First World War strategy of sending in an ever-increasing number of troops, in the hope of achieving a breakthrough. It may be open to similar objections – producing, if not fatalities, then deep fatigue and frustration. Increasing the flow of women through the pipeline – by removing blockages to entry and exit from PhD programmes – is a necessary but insufficient policy. For women to attain the maximum value from their investment in postgraduate study, we must recognize that the quality of PhD training and work experience is as important as the number of degrees awarded.[16]

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[15] Elaine Seymour and Nancy M. Hewitt, *Talking about Leaving: Why Undergraduates Leave the Sciences* (Boulder: Westview Press, 2000).

[16] Henry Etzkowitz, Carol Kemelgor, and Brian Uzzi, *Athena Unbound: The Advancement of Women in Science and Technology* (Cambridge: Cambridge University Press, 2000), 83–104.

BREAKING THROUGH OR BREAKING DOWN: BUSINESS VS ACADEMIA

A more promising breakthrough is precisely what Laurel Smith-Doerr has found in the form of biotechnology 'start-up' companies. It seems that a mix of organizational and professional rigidities and social attitudes may hinder women more in academic science than in industrial labs.[17] Contrary to those who argue that due process is the best method of advancing women's careers, Smith-Doerr finds hope in non-bureaucratic organizations. Biotech firms are more likely to offer women scientists what they want – a flexible workplace, flat organizational structures, and an emphasis upon teamwork and cooperation. In such organizations, networking skills are also more highly rewarded. Entrepreneurial and network-based businesses tend to recognize the achievements of all contributors, while hierarchical organizations more often winnow out those who are not in step with the leadership. For example, women in Smith-Doerr's sample of small commercial companies are eight times more likely than their academic counterparts to head a lab.

But what about academia? It is well known that women are often well represented when a new field emerges. For example, women researchers were present in the 'fly room' during the early days of genetics, when the field did not have high status; and were then pushed out as the prestige of this discipline increased.[18] However, Smith-Doerr finds that the 'beachhead' in biotech is holding, and that women have continued to move up in the industry. Their collegial, less hierarchical teams are similar to the 'relational' research groups that some women have tried to establish in academia.[19]

The most crucial relationships for PhD students are those they have with their advisors and fellow students. Loss of confidence, self-blame, isolation, and confusion arise from poor relationships. Women graduate students report problems with getting attention and support. A doctorate can become merely a formal achievement, if it is not accompanied by close integration into the scientific

[17] See, for example, J. Glover, 'Highly Qualified Women in the "New Europe": Territorial Sex Segregation', *European Journal of Industrial Relations* (forthcoming); Namrata Gupta and Arun K. Sharma, 'Women Academic Scientists in India', *Social Studies of Science*, 32 (5–6), (2002), 901–915.

[18] Robert Kohler, *Lords of the Fly: Drosophila Genetics and the Experimental Life* (Chicago: University of Chicago Press, 1994), 36, 94–96.

[19] Etzkowitz, Kemelgor, and Uzzi, *op. cit.* note 16, 153–154.

community. Apparently, few women who win advanced degrees acquire the same density of professional connections that accrues to men. Conferences are a critical zone of contact, where connections are made and careers built. However, successful conference participation depends upon more than travel funds. An advisor's introduction makes all the difference, and women give this experience mixed reviews.

Indeed, such contacts have not yet become routine 'rites of passage' into welcoming communities. As women ascend the educational ladder, they encounter either arbitrary authority or inattention. Managing multiple experiences and conflicting role expectations reflects what has been termed the 'triple burden' of dealing simultaneously with the demands of home, profession, and a gendered work environment.[20] This regime – despite the practice of strict time management and self-discipline – too often leads to physical and mental exhaustion. To cope with these pressures, many women end up postponing research, foregoing advancement opportunities, and lowering their career ambitions.[21] This is how hierarchical organizational structures, patriarchal attitudes, and a lack of networking opportunities contribute to gender inequality. No wonder so many women academics' research productivity does not peak until they reach their fifties.

Evidence of the 'triple burden' can be found around the world, indicating the significantly adverse impact of cultural values and organizational structures on the careers of all academic women in science and engineering.[22] Successful women scientists attribute their achievement to positive experiences and supportive mentors. However, the value of a good start can be so easily put at risk when negative multipliers begin to accumulate. In this context, Smith-Doerr's conclusion that organizations should consider moving away from rigid hierarchical structures to a more level playing field appears to hold some promise.

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[20] Namrata Gupta and Arun K. Sharma, 'Triple Burden among Women Scientists in India: A Sociological Study of Women Faculty at Some Reputed Centres of Higher Learning and Research', *Social Action*, 51 (4), (2001), 395–416.

[21] *Ibid.*

[22] Namrata Gupta, Carol Kemelgor, Stephan Fuchs, and Henry Etzkowitz, 'The "Triple Burden": A Cross-Cultural Analysis of the Consequences of Discrimination for Women in Science', in *Gender and Excellence in the Making* (Brussels: Directorate-General for Research, European Commission, 2004), 41–50.

TOWARDS CHANGE

The reluctance of the (generally male) scientific establishment to acknowledge institutional discrimination may be weakening. The watershed report by senior female faculty at MIT – who found (to their surprise) systematic differences between the research space and salaries given to men and women academics – evoked a commitment from then President Charles Vest to rectify the situation.[23] The sponsors of the Space Telescope Institute have promised action in the face of similar findings.[24] In response to Lawrence Summers' remarks, the American Association for the Advancement of Science has issued a statement reaffirming its commitment to gender equality. Statements by the presidents of Princeton, MIT, and Stanford – two of them women – recognize the differences between men and women's biological and academic cycles.[25] However, while providing general guidelines for change, they stop short of proposing specific reforms.[26]

Extraordinary measures have pushed the limits of reproduction; but it is the academic cycles that have remained inflexible.[27] A Science Policy Roundtable at Stanford on 'Gendered Innovations in Science and Engineering' recently discussed this problem.[28] While the roundtable pointed to the connections between science, gender, and society, most proposals for change were not dependent upon a gender revolution. Instead, they tended to involve a mix of role, organizational, and social changes, many of which have already been instituted in other countries. For example, a proposal for child-care allowances for academics with young children – which might be considered radical in the USA – is established policy in

[23] Robin Wilson, 'An MIT Professor's Suspicion of Bias Leads to a New Movement for Academic Women', *Chronicle of Higher Education*, 46, (3 December 1999), A16–18.

[24] 'Review of the Status of Women at STScI', *http://www.aura-astronomy.org/*, accessed 5 May 2005.

[25] John Hennessy, Susan Hockfield, and Shirley Tilghman, 'Look to Future of Women in Science and Engineering', *Stanford Report*, XXXVII (17), (18 February 2005), 8.

[26] Daniel Hemel, 'Presidents of MIT, Princeton, and Stanford blast Summers' Remarks on Women', *Harvard Crimson*, 14 February 2005.

[27] Carol B. de Wet, G.M. Ashley, and Daniel P. Kegel, 'Biological Clocks and Tenure Timetables: Restructuring the Academic Timeline', Supplement to *GSA Today* (November 2002), 1–7, *http://www.geosociety.org/pubs/gsatoday/0211clocks/0211clocks.htm*, accessed 5 May 2005.

[28] See *www.stanford.edu/group/IRWG/*, accessed 5 May 2005.

neighbouring Canada. A requirement that 50% of academic positions be held by women has been instituted in Sweden. US authorities in Iraq recently encouraged the introduction of a one-third rule into that country's reconstructed political system. The idea of granting tenure on hiring – suggested at the Stanford Roundtable by Dean Sue Rosser to obviate the greater pressures to which women are subject earlier in the life cycle – is commonplace in Norway and Australia.

President Summers highlighted the issue of time at the workplace. A conference participant said that 'an 80-hour-a-week job is especially hard for women to contemplate, along with doing other things with [their] life'. Professor Londa Schiebinger, the conference convener, noted that the academic working week is sixty hours at Stanford, 'a demanding, but not impossible schedule' that also applies nationally. A significant part of work at the elite research universities is spent in comfortably furnished offices that are coming to have the look and feel of living rooms, compared with the academic cubby-hole or 'hot desk' commonplace at lesser institutions. Women scientists discuss their work with colleagues over the Internet, late at night (as do many men). However, the prevalent male model of doing science puts a premium on time actually spent at the work site – in full view of one's superiors – as evidence of their commitment. Just as the practice of science has changed, so its social structure will evolve further.[29]

Sue Rosser defines five stages in the historical progression of women in science.[30] Her analysis of the acceptance of women in science can be universalized by examining the treatment of women in other scientific cultures, where the rate of change and the precise barriers may differ, but the essential features of gender discrimination obtain.[31] In the first stage, women are absent from the laboratory, and their absence is simply not noted. In the second, some women enter the laboratory, and their presence is tolerated as long as they accept the fact of male dominance. No concession is made

[29] Mary Wyer, Donna Cookmeyer, Mary Barbercheck, Hatice Ozturk, and Marta Wayne (eds.), *Women, Science, and Technology: A Feminist Reader* (London: Routledge, 2001).

[30] Sue Rosser, *The Science Glass Ceiling: Academic Women Scientists and the Struggle to Succeed* (New York: Routledge, 2004), 50–57.

[31] Veronica Stolte-Heiskanen, 'Women and Science: The Role of Gender Relations in Knowledge Production', *Current Sociological Perspectives*, 6 (1/2), (1987), 121–142.

to their presence.[32] In the third stage, women begin to challenge their low status by forming support groups and issuing reports. In a fourth phase – perhaps provoked by incidents like the Summers controversy – institutions begin to acknowledge the contribution of women to their labs, and even recognize a diversity of scientific styles, including some possibly related to gender. Provision of day care and extensions to tenure reviews so as to accommodate children are likely to follow in this stage.[33] The fifth phase in the progression of women in science is reached when their labs are redefined to promote inclusivity and to embrace the premise that diversity promotes creativity. For the record, Rosser locates the respondents to her survey in one or another of the middle three stages. None of them is experiencing either the exile of Stage One or the Nirvana of Stage Five.

Ultimately, those in positions of power – such as Summers, Hennessey, Hockfield, and Tilghman – and reforming organizations, such as the Association of Women in Science (AWIS) and High-Tech Women.com, have the responsibility of making institutions more 'friendly' to women. Increasingly, successful women have created their own grapevines, directing other women to departments where they can collaborate and take risks. Some women scientists forfeit prestigious appointments for environments where they can more easily thrive. As advisors, successful women are directing students to women-friendly environments, where the 'two-body problem' – the tenure clock versus the biological clock – is openly recognized.

The use of regular 'body counts' of PhD production, by sub-discipline and department, is an important first step. But 'quality of academic life' indicators are also needed. Biotechnology firms – organizational hybrids combining traditional academic and industrial science – may point the way. To achieve 'a fair shake', it will take many more volumes, soul-searching conversions, and targeted efforts. Perhaps the response to President Summers – including his appointment of two committees to improve the condition of under-represented groups at Harvard – may transform the unsympathetic environments so carefully documented in these timely books. Nev-

[32] A classic example is that of Lise Meitner, who was forced to walk several blocks to a nearby hotel, due to a lack of sanitary facilities at the institute in pre-war Berlin, where she was grudgingly allowed to have a basement lab. See Ruth Sime, *Lise Meitner* (Berkeley: University of California Press, 1996), 23–45.

[33] Sara Rimer, 'For Women in Sciences, Slow Progress in Academia', *The New York Times*, 15 April 2005, 1.

ertheless, it is hard to be sanguine about a system that has proved to be so painfully resistant to change.

A Modest Proposal

Several years ago, the late Barbara Lazarus (then Associate Provost at Carnegie-Mellon University) and some of her colleagues proposed the creation of a female computer science department.[34] We suggest that a grander project is required to fire public support for the advancement of women in science – much as the American women's dramatic fundraising campaign did for Marie Curie's research following the First World War.[35]

Perhaps an even more radical strategy may lead to the development of a women's graduate school in the sciences. Such a school could possibly be built upon the base of a distinguished women's college with strong undergraduate programmes in the sciences and engineering. Public and private grants could support a living example of Dean Rosser's currently utopian fifth stage, in which women are fully accepted. The prospect of achieving such an institution, and the process of realizing it, could also inspire change in mainstream academia. The mere existence of such a model could encourage both emulation and internal reform in co-educational institutions.

Of course, institutions may not always receive credit for their reforms. A larger than usual number of women was recently elected to the US National Academy of Sciences. In response to a reporter's question as to whether President Summers' remarks had contributed to their election, the Academy cautioned against drawing inferences from statistics based on small numbers.[36] If and when equality for women in science is achieved, his intervention and the controversy it provoked may well mark a turning point in the struggle for a 'normal place' for women in academic science.

Academia and science have lagged behind business and industry in promoting gender equity. This surely makes it imperative for uni-

[34] Barbara Lazarus, interview with Henry Etzkowitz, 1992. See also S. Ambrose, B. Nair, D. Lazarus, and K. Harkus, *Journeys of Women in Science and Engineering: No Universal Constants* (Philadelphia: Temple University Press, 1997).

[35] Barbara Goldsmith, *Obsessive Genius: The Inner World of Marie Curie* (New York: W.W. Norton, 2005), 192–194.

[36] Cornelia Dean, 'National Academy of Sciences Elects 19 Women, A New High', *The New York Times*, 5 May 2005, Section A, 20.

versities to act on President Summers' belief that 'the advancement of women in science is profoundly important for our university and our country, and has never been more important'.[37]

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[37] Lawrence Summers, talk to the National Symposium for the Advancement of Women in Science in April, 2005, *http://www.president.harvard.edu/speeches/2005/nsaws.html*, accessed 5 May 2005.