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GENDER EQUITY IN SCIENCE AND TECHNOLOGY AND THE PUBLIC COMMUNICATION OF S&T

Dr. T V Venkateswaran
Scientist F, Vigyan Prasar,
Dept of Science and Technology
Government of India
New Delhi
Website: www.vigyanprasar.gov.in
Email: *tvv@vigyanprasar.gov.in*

Abstract: The role played by media and the social reality that it engenders in modern society has been well recognised. The gendered nature of science and its re-presentation has been investigated in the past few decades by feminist scholars and also sociologist of science. Patriarchal ideologies and extant gender biases of the society influence science, in so far it is a human activity, especially in its interpretation and re-presentation. This paper briefly provides an overview of the gendered nature of science, the gendered media coverage and discusses the role that need to be played by science communicators for binging about gender equity in science and technology (GEST).

Introduction:

Gender bias have had imperative in shaping the careers of scientists for centuries. Ideologies of patriarchy that prevailed hitherto, in cultures all over the world, have resulted in exclusion of women from knowledge production and higher learning for a long time. In some societies strictures were in place to bar women from even basic education, and when grudgingly school education was opened up as part to meet the needs of the modern capitalist society, women were barred entry to universities, until a few decades ago. Education, in particular higher education, it was posited would distract women away from her 'natural duties' of a homemaker and child care giver. Science was also thought to be unsuitable and a burden for the feeble mind of women. Thus, science and especially, technology, has been considered 'masculine' for a long time and gender gap in science has been is observed in most societies. The social norms, societal structure, relationship between family and work, and the organizational processes of

scientific institutions, have created a series of interrelated problems for women in science.

Structural and organizational barriers for entry and growth of women in the institutions of science have been well studied. While overall participation of women in knowledge production world over is low, in science it is even dismal. In India too, the status of women in science is not encouraging. Given the prevailing gender imbalance, mainstreaming gender in science – or Gender Equity in Science and Technology (GEST) is recognized to be necessary. Absence of women, especially if constrained by the social structure would imply an underutilization of the fifty percent of the 'intellectual reserve'. Efforts are being made world over to correct the gender imbalance and attract young girls and women into science and scientific research. For women themselves, opening up of such possibilities make possible for them to realize the human potential to its full capacity.

At entry level the percentage of girls in higher education, including PhD, is significant, and India ranks in the top ten list of countries with higher participation of women in higher education. However when it comes to women entering research carrier, there is what is described as 'leaking pot' phenomena. This unique and enigmatic phenomenon is attributed to social attitudes in Indian society, the amount of time women have to take off to start family resulting in late start, social pressures and unfair gender bias in hiring policies and so on. The prevailing socio-cultural systems in India that result in a 'triple burden' for women in academic and scientific careers are also a deterrent[1].

A study conducted in India[2] reveals that female and male scientists do not differ in terms of research-related attitudes and higher proportions of women at lower ranks are not a simple function of low research productivity. The female scientists do not differ significantly with male scientists in terms of research contributions, yet are not provided opportunities to grow and lead, leading to a situation where less than one percent of the top level in S&T institutions are women. Bringing about a change in the societal attitude could encourage pure science career for women.

While the gender questions in science are important and crucial, equal attention needs to be paid to the gendered nature of science itself and the gendered media interpretation/presentation[3]. For, it is through these media images social reality is

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[1] Science career for Indian women: **An examination of Indian women's access to and retention in scientific careers**: **Report**, Indian National Science Academy, New Delhi October 2004. Accessed on 7th Jan 2012. http://www.ias.ac.in/womeninscience/INSA_1-17.pdf and Namrata Gupta et al, Triple burden on women in science: A cross-cultural analysis, **Current Science**, Vol. 89, No. 8, 25 October 2005, pp. 1382-86

[2] See Neelam Kumar , **Women and science in India, A reader**, oxford University Press, New Delhi 2009 and Gupta, N., and A. K. Sharma, Women academic scientists in India. **Social Studies of Science** Vol. 32 (5-6)2002, pp. 901-915.

[3] Lederman, M. and Bartsch, I., (eds.) **The Gender and Science Reader**, New York: Routledge, 2001 and also Irigaray, L. "Is the Subject of Science Sexed?" in **Feminism and Science**. N. Tuana (ed.). Bloomington: Indiana Univ. Press1989: pp.58–68 for an overview.

constructed, gender imbalance is reified and girls have to struggle to attain a place in the science. It is in this background that the first section of this paper discusses the gendered nature of science. The second section summarises the research findings of the portrayal of women scientists in visual media, i.e. TV and films, as well as WWW. It is by consuming such portrayals girls, young women and society at large normatively construct their image of women scientist. In the third section we offer ideas that a science communicator could take to set right the gender imbalance in media and contribute to GEST.

Gender bias in science

As an ideal science aims to attain absolute objectivity free from all biases, however, in so far as science is human activity, it is but natural that cultural and socio-political aspects influence science both in institutional terms as well as its public re-presentation. Even though one may challenge the notions of constitutiveness of the culture and social in science at least in the (re) presentation of science[4] has been amply adduced by recent scholarships.

Women are responsible for half the human knowledge and technical expertise; women have been agriculturalists, gardeners, animal breeders, harvester of sea and forest users. They have traditionally played a major role in post harvest production and are crucial in keeping the community health. They contribute to the material wellbeing of the household and community through their management of water and hygiene needs and resources and spend hours each day meeting the household energy needs. Though one would abhor in romanticising these activities oblivious of the drudgery involved, it is important to recognize them as specific expertise. Yet, like most activities of the underprivileged sections, many activities that involve proficiency of some sort, when are the traditional role performed by women are not considered 'expertise'. This leads to a "gender-polarized society" where the women are seen as 'primitive' lacking mental skills and rational mind.

The part played by the life sciences in justifying the subordination of women has an embarrassingly long history and has been used in naturalising women's physical and intellectual inferiority. In the area of reproductive biology, imagery used to describe the fertilisation of ovum with sperm in textbooks and popular literature is fraught with stereotyping of gender roles. Often ovum and egg are personified and sperm is vested with active agency ('active', 'forceful', and 'self propelled') while egg cells are described in passivity (swept). So much so that the scientific community was very slow to

[4] See for instance, Philip Kitcher, **Science, Truth and Democracy**, oxford university press, New York, 2001 and specifically Bleier, R. **Science and gender: A critique of biology and its theories on women**. New York: Pergamon Press, 1984 for a overview of the gender biases in scientific practice today.

recognize evidence of 'cryptic female choice' as it did not fit with the beliefs about the role of the female because scientists were still entrenched in a male view of sexuality[5].

Popular treatment of paleoanthropology[6] continues to perpetuate the notion of females as passive actors on the stage of human evolution, quietly foraging and raising children in the background while males manufactured the stone tools and were regarded as being at the heart of communicative and trade networks. This picture crystallised around 1960s with the "Man the Hunter" theory of the human evolution[7]. "Killer Ape and Man the Hunter" theories sought to explain the evolutionary trajectory of human prehistory with man's aggression and big-game hunting in cooperative groups. It was posited that these processes kick-started language, communication and civilisation. Man was placed at the centre of a positive feedback loop linking cultural and biological developments, associated with hominid origins, with women just playing a support and perhaps romance role.

Men might kill one giraffe and talk about it around the fire at night for a year until another is killed; they often fail to catch enough prey to sustain the family, and this task falls to women. Hunting, it appeared was not the main source of calories in the primitive societies, but foraging and gathering – typical work relegated to women - was. Supported by data from hunter-gatherer peoples and other primates, researchers suggest that women's foraging for plant materials and tool-making skills were centrally important in human evolution[8]. Yet gender bias has clouded the scientific thinking and pictures / illustrations of past age routinely depict women in the hearth baby tucked in arm pit, while a group of men hunt a big game. Deeply entrenched gender bias is in our representation /re-presentation of knowledge is evident to careful scrutiny. Over the years, feminist studies have revealed and unravelled gender bias in neuroscience[9] (for

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[5] Emily Martin, The Egg and the Sperm: How Science has constructed romance based on stereotypical male-female role, **Sings**, Vol 16. No 3 1991 pp 485-501.

[6] For a recent controversy see TV Venkateswaran, Did Ardi Walk for Sex? Gender, Science and World Views, **Economic & Political Weekly** January 15, 2011 vol xlvI no 3, also LD Hager, Sex and gender in paleoanthropology, in Hager(ed) **Women in human evolution**, Rutledge, London 1997, pp1-21; also Fedigan, L. M., , "The Changing Role of Women in Models of Human Evolution", **American Review of Anthropology**, vol. 15: 1986,pp.25–66.

[7] Lee, R. B. and I. DeVore, (eds.), **Man the Hunter**, Chicago: Aldine1968.

[8] See Ernestine Friedl, **Women and Men: An Anthropologist's View**, Holt, Rinehart and Winston, New York. 1975 and Dahlberg, Frances (ed.). **Woman the Gatherer**, New Haven: Yale University Press, 1981 for the 'active' role women plays in hunter gatherer economy and social life also Brumfiel, E. M., , "Weaving and Cooking: Women's Production in Aztec Mexico," in J.M. Gero and M.W. Conkey (eds.),Engendering Archaeology: Women and Prehistory, Oxford: Blackwell1991.

[9] See for a overview Cordelia Fine, **Delusions of Gender: How Our Minds, Society, and Neurosexism Create Difference**, W.W Norton Co, New York 2010 and Brizendine, L. The Female Brain, New York: Morgan Road Books2006.

eg, allegedly women have lower mathematical ability); primatology[10]; animal behaviour[11], medical sciences[12], drug testing[13] and so on.

Images of Female Scientists in Popular Films & Television

Many children grow up in "gender-polarized society", on the one hand accepting traditional stereotypes of women that portray women as passive, emotional, physically weak, helpless, giving, expressive, dependent, and concerned with social roles and family obligations while on the other they learn stereotypes of men that portray men as aggressive, smart, strong, active, self-confident, blunt, and analytical. In these circumstances girls grow up viewing themselves through the "lenses of gender" and are subjected to intense pressure from the parents and peers to adhere to traditional gender roles. Traditional female roles among others include aspects like women's interest in appearance and beauty, women's interest in domestic skills, women's concern for the care and nurture of others, and women's preoccupation with romance. Traditional female roles often are reinforced by socializing agents at home, in schools, and in popular culture that convey social expectations for women with regard to their physical appearance and body images, personal relationships, sexuality, and professional roles.

Adolescence is a turbulent time for girls, when they face an array of psychological, social, behavioural, cognitive, and physical changes. It is also the time when the girls first begin to develop identities or self-images. In contemporary milieu visual mediums such as television and cinema play a significant role in shaping the identity formation and the current representations of self, or their "working self-concepts" guide their behaviour and influence the choices they make. During this self identity formation period, adolescent girls consider an array of "possible selves" in which the conceptions of gender play a critical role. The fear of being outcast by peers as 'tom boy' or as 'loose' and the desire to be popular force even the brave ones among them to hesitate to break the traditional barriers.

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[10] Fedigan, L. M., and L. Fedigan, , "Gender and the Study of Primates", in **Critical Reviews of Gender and Anthropology**, S. Morgan, (ed.), Washington, DC: American Anthropological Association1989.

[11] Sperling, S., , "Baboons with Briefcases: Feminism, Functionalism, and Sociobiology in the Evolution of Primate Gender", **Signs**, vol.17,1991: pp.1–27.

[12] Lerner, B. H., , **The Breast Cancer Wars: Hope, Fear and the Pursuit of a Cure in Twentieth-Century America**, Oxford: Oxford University Press2001

[13] Eichler, M. and J. Lapointe, , **On the Treatment of the Sexes in Research**, Ottawa: Social Sciences and Humanities Research Council of Canada 1985 also Epstein, S., **Inclusion: The Politics of Difference in Medical Research**, Chicago: University of Chicago Press 2007.

Social learning theory explains how children learn specific attitudes and behaviours from the images and characters they encounter in the media in particular in cultivating their image of "possible selves". While the actual models in their lives such as parents and teachers have an impact, the symbolic models in their social environments, such as those depicted in the media mediate these ideas through a process of "identificatory learning". Media images are not as such directly etched in to the behaviour roles of the adolescents but are influenced by "(1) a viewer's perceptions of the salience of an issue, (2) the personal experience a viewer has had with persons in the occupation also held by the media model, (3) a viewer's ability to comprehend and interpret the behaviour of media models, and (4) the cumulative impact of other socialization agents in a viewer's social and cultural environment"[14].

As children progress through school and start to consider their future careers, their ambitions begin to differ. Often we observe that the girls predominantly tend to be more interested in arts and humanities courses (languages, literature, psychology etc.) and boys are more likely to prefer science and technology courses. Such sex role differentiation is often attributed to innate biological sex differences is perhaps most likely an illusion. It has been argued that such sex roles are outcome of, or at least mediated by, the popular gender stereotypes that prescribe different behaviours and qualities to men and women[15].

The popular media of film, cinema, and television—in the area of documentary as well as fiction—contribute to a general overall picture and also to the public understanding of science. Either explicitly or unintentionally media portrays stereotypical images of scientists in general and women scientist in particular. What is the image of women scientists offered in feature films? How do these images of women relate to scientific reality? Have the representation of women scientists changed over a period of time? What is the significance of this within a broader social context? Mass media, including film's images of reality influence the audience and have a central function in the creation of opinions and myths. As film creates pictures, they work more than a simple mirror; it also works as social memory and cultural metaphor and have a far greater impact in creation of social myths on gender and science[16]. It is in this context that the images of female scientists and engineers presented in popular films play the role of

[14] Steinke, J. 'Cultural representations of gender and science: portrayals of female scientists and engineers in popular films', **Science Communication**, vol 27, 2005: 27–63

[15] Steele, C. M.,"A Threat in the Air: How Stereotypes Shape Intellectual Identity and Performance", **American Psychologist**, vol.52, 19976, pp.13–29.

[16] See Elena, A. 'Skirts in the lab: Madame Curie and the image of the woman scientist in the feature film', **Public Understanding of Science**, vol.6: 1997, pp.269–78. And Gerbner, G. 'Science on television: how it affects public conceptions', **Issues in Science and Technology**, vol 3: 1987, pp.109–15. And Kanner, M. 'Going on instinct: gendering primatology in film', **Journal of Popular Film and Television**, Vol33: 2006, pp.206–12 for an overview of the issues involved in portrayal of women scientists in films.

symbolic models that serve as sources of information about women, gender roles, and female scientists and engineers to growing adolescents. As symbolic models, these images have the potential to shape adolescent girls' perceptions of gender roles and their own future roles, including their perceptions of scientists and engineers and their interest in scientific and engineering careers.

Television and films have been having deeper impacts as a media on the way society constructs its social reality. Of the 74 science based Hollywood films of the 1990s, a study by Jocelyn Steinke[17] found that only 33 per cent (25 films) featured female scientists and engineers. This study suggests that depictions of female scientists and engineers in these films often emphasized the femininity of the featured female scientists and engineers. However the study also shows that emphasis of the femininity did not urge conformity to traditional stereotypes of women.

While many of the female scientists and engineers in these films were performed by young, popular, and glamorous Hollywood actresses and hence were attractive and romance was a dominant theme in the films, these films presented female scientists and engineers in professional positions of high status. Female scientists and engineers featured in these films, were shown in positions of high prestige, such as project directors or equal members of research teams, and were knowledgeable, articulate, outspoken, driven, confident, competent, creative, and independent. The female scientists and engineers were rarely shown compromising their professional positions for romance. Such portrayal of women in prestigious positions may provide adolescent girls with positive role models, even when these portrayals emphasize their appearance and focus on romance.

Though unlike the past the female scientists/ engineers in these films were not merely sidekicks and did not always conform to traditional gender stereotypes. However, female scientists still corresponded to traditional notions of femininity in appearance and dress, and romance was a dominant theme in these films. In addition, female characters reinforced social and cultural assumptions about the role of women in science and engineering. They were mostly portrayed as single and not having a children. In another study by Flicker[18], who analyzed about 60 feature films and found that the clichéd description of "mad scientist" does not apply to women scientists in films. Women scientists are typically portrayed in one of the following six stereotypes: 1. The old maid, 2. Tom boy, 3. The naive expert, 4. The evil plotter, 5. The daughter or assistant, 6. The lonely heroine. However in most of these films the role of the professional "scientist" is reserved for men; women are represented in less than a fifth

[17] Steinke, J. 'Cultural representations of gender and science: portrayals of female scientists and engineers in popular films', **Science Communication**, vol 27, 2005: 27–63.

[18] Flicker, E. 'Between brains and breasts: women scientists in fiction film: on the marginalization and sexualization of scientific competence', **Public Understanding of Science**, vol.12, 2003, pp.307–18.

of these films that he surveyed. Nevertheless one the whole female characters in feature films do not contribute to the build-up of negative myths surrounding the image of science

Often, when the women scientists in feature films work in teams, their positions are subordinate to those of their male counterparts. Also analyzing the films from the dramaturgical perspective, he argues that the character of the woman scientist is often employed to enable suspense in the plot. Their characters are sketched such that they bring in intuition, emotional elements, love affairs, and feelings in the storyline, thus their 'female' is highlighted in contrast to their professional identity of 'scientist'. They hardly are represented as bringing in the rational scientific, which is usually left to their male colleagues. That is their character sketch makes them 'inferior scientists' by strategic marginalization.

Another area that should attract our attention is the depiction of women in the visual media. Women and women's body as erotic and it role in construction of women as a commodity in the contemporary age, in particular neo liberal age, has been a subject of feminist scholarship for some time now. What is the scene in Indian films? Do pretty young women is able to go beyond washing test tubes or holding candle for their husband/'lover' scientists and engineers in Indian films? What images do bollywoods churn in its creations? It is pertinent to examine this question.

Visual images and gender

Visual culture studies have been used by science communication theorists to examine the depiction of women in contemporary visual images connected with S&T communication. Visuals enter into re-presentation of modern science as illustration in textbooks, anatomical drawings, museum panels, diorama depictions, iconic representation and popular science publications. The co-evolution of the visual culture during the second half of the twentieth century along with visual mediums like posters, television etc has replaced the story telling process with that of visual representation. These images are increasingly consumed by an audience who are at ease with visuals than critically reading texts and are often not usually equipped to sift scientific fact and artistic fiction in these images.

Careful reading of these visuals that are increasingly being used to re-present and communicate science, such as evolution and in particular human evolution are not as 'innocent' images as they appear at first sight. Wiber[19] demonstrates that 'research into human origins and its visual representations of itself are far from independent of the biases present in the socio-political milieu out of which they have arisen. Her interesting and informative book enables the reader to perceive more clearly'. This work exemplify how these accounts of the past rooted in the present are used and misused to

[19] Melanie G. Wiber, Erect Men, **Undulating Women: The Visual Imagery of Gender, `Race' and Progress in Reconstructive Illustrations of Human Evolution**, Waterloo: Wilfrid Laurier University Press, 1997

reproduce and solidify dominant views and misconceptions about gender roles, racial features and ideas about evolution. In her work she reports the responses of her students, whom she used as a control sample in interviews and blind tests to give some indication of how the average person would perceive these images.

With her study she is able to argue convincingly how the illustrations of the human origins story have for many years reserved to our male ancestors the protagonists' role in the sequence of evolutionary events. At least four million years of human prehistory are habitually represented by the image of a procession of males marching towards the ultimate destination of biologically and anatomically modern humanity.

In these typical visuals, the archetypal image of Homo sapiens sapiens is a man with light skin and Caucasian features. His ancestors, also male, become darker and acquire more ape-like features as they move further back in time. The female role in the evolutionary procession is a minor one, endorsing, in effect, the older and more persistent 'Man the Hunter' model. The usual museum dioramic representations of the daily or ritual life of any sort of hominid typically show only a few females, usually occupying marginal positions in the image's layout and pursuing activities that are not vital to the species' survival. The men are muscular, involved active works like hunting or protecting the tribe, whereas the women are in heart cooking the meal or nursing the babies or hiding behind a bush from a wild animal[20]. The message is clear: the male is the active, powerful provider and the female the passive, subordinate consumer. Not surprisingly, the 'Woman the Gatherer' model rarely makes it into illustrations of this sort, leaving the general audience comfortably ignorant of any discord on the subject amongst human origins researchers. Women, however, are not alone in being thus set apart by such illustrations; women are often joined by children and 'coloured' racial categories in being classified as 'primitive'.

Science, Media and Gender

GEST (gender equity in science and technology) not only means more women in S&T but also more S&T for women, in particular underprivileged women. S&T in this perspective should seen as a tool for expanding human rights, engendering gender equity and fostering social and economic development of women, especially from underprivileged sections. Further the discrimination and distortions also through the manipulation of communication, the management of the communication channels, the production of images and stereotypes, the use of symbols, and so forth. Thus for engendering GEST it is necessary to address the role played by media.

[20] Gifford-gonzalez, D., 1993. You can hide but you can't run: representations of women's work in illustrations of Palaeolithic life. **Visual Anthropology Review** 9(1):pp.23-41.

If we understand science communication as not just mere transmission of scientific knowledge, but as the inter-subjectification[21] of science as a social enterprise, then science and society issues also become legitimate concerns of science communication. It is in this perspective that UNESCO[22] advocates 'S&T reports' as one of the key areas of focus while formulating guidelines for gender mainstreaming in S&T, underlining the critical role the media plays in engendering GEST.

As the mass media have become a key means for publicizing scientific production and research results and as most people have never and will never personally meet a scientist, media become the primary source through which ordinary publics will take a peek at science. As gender is 'politically correct' principle today, it does find a place in the media of contemporary times, however, often it is a tokenistic rhetoric routines of the press[23] and reflects the gender imbalance in media representation. Far more dangerous is the insidious gender blinkered media stories.

Recent penchant for evolutionary psychology coverage in media, amply demonstrates the interrelation between science, media and gender questions. Pop evolutionary psychology paraded by media is not only highly contested in terms of academic science, but also highly controversial in political and social terms, having implications for many contemporary concerns of gender politics, such as monogamy, adultery and divorce; or similarly the nature of work in and outside of the home. Much of the popular debate in the media over evolutionary psychology is in reality a discussion about social, rather than natural, scientific expertise. In fact a study on the coverage of the evolutionary psychology reveals that most of the media coverage 'is dominated by discussions of the implications of evolutionary psychology for issues of sexuality and gender politics'[24]. Thus the media stories go on to reinforce the myths such as 'male brain/ female brain'.

As more and more young people are used to new media and internet is becoming more and more accessible, the World Wide Web can become important sources of information about women in science, engineering, and technology. A study[25] on the images of women scientists and engineers on WWW analyzed the content of 27 science and engineering Web sites for girls and examined recurring themes in 168 of the biographies of women scientists and engineers found on these sites. Interestingly the these Web sites addressed issues concerning parental attitudes, acceptance by male colleagues, and family-friendly policies in workplaces— issues shown to be related to girls' future interest in careers in science, engineering, and technology. The study points

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[21] Giancarlo Quaranta, Knowledge, responsibility and culture: food for thought on science communication **Journal of Science Communication**, (4), December 2007

[22] **Guidelines for Gender mainstreaming in Science and Technology**, UNESCO, Jakarta, 2004.

[23] Orly Shachar, Spotlighting women scientists in the press: tokenism in science journalism, **Public Understanding of Science**, vol. 9 no. 4 2000 pp. 347-358.

[24] Cassidy A, Popular evolutionary psychology in the UK: an unusual case of science in the media?, **Public Understanding of Science**, Vol. 14, 2005,pp. 115–141 also see ref 8 above.

[25] Jocelyn Steinke, Science in Cyberspace: Science and Engineering World Wide Web Sites for Girls, **Public Understanding of Science** January vol. 13, 2004,pp. 7-30.

out positive action is possible and underscore the need to pay attention to this fast emerging media, which is poised to have a far greater impact on the young people today.

Role of science communicators

In one particular imagination, science communicator is akin to a film critic *a la* Maurice Goldsmith[26]. Perhaps, science communicator does not produce 'science', but nevertheless a crucial element in its cultural re-production and re-presentation. Maurice Goldsmith argues that as a science critic, the science communicator is expected to see the whole picture, with grounding in history and sociology of science, interpret and communicate science to public. In doing so, as a critic s/he may also hold a mirror before the science community even while creating a public sphere for science.

As a science critic, it is important for science communicators to be aware and critical of the gender bias that pervade various aspects of our social life including that of science. If the objective of the science communication is to reduce the inequalities among different strata of the population; empower disadvantaged sections of the society and create a just, fair, rational and equitable society, then addressing the gender bias is as much important as issues pertaining to rationality. A science communicator needs to :-

a) present positive role models – Studies have shown that girl students often do not opt for sciences and this trend is closely related to, among other things, absence of role models. Except for a few canonical icons like Mary Curie and few others, women in science are hardly known. To illustrate[27]; first ever computer programmer is a women- Ada Lovelace; Lise Meitner's contribution to the understanding of nuclear fission is crucial; painstaking study of Henrietta Leavitt that resulted in development of 'standard candles' for measuring the distances of deep space objects in the universe (Cepheid variables); Marie Tharp discovered the mid-Atlantic ridge and paved way for the modern theory of ocean floor spreading. However, hardly women scientists are highlighted in the popular science writings. Absence of women in the popular narratives (including the textbooks) results in emotional alienation of girl students.

Further, often when science writers choose to profile women scientist, the lament factor (how they had to struggle and come up) predominates and the sense of fulfilment a women scientists is pushed backward. Indeed it is true that women, and many other disadvantaged sections, against odd make it, and their struggles needs to be documented and told. However to play a positive role model and attract young girl students to science, we need profiles that highlight how women achieve and feel the

[26] Goldsmith M, **The Science Critic: A critical Analysis of the Popular Presentation of Science**, Rutledge & Kegan Paul, London, 1986.

[27] See Lisa Yount, **A to Z of Women in Science and Math**, Fact on file inc., raised ed 1999 for (mostly European) women scientists and **Lilavahi's Daughters**, Indian Acd Of Sience, Bangalore for a collection of biographies of Indian women scientists.

sense of elation (like any scientist would), wonderment, sense of fulfilment and joy at solving a puzzle of nature.

b) critical of gendered images: Stereotypical images that media produces also contribute to gender bias. The stereotype of computer scientists as geeks who memorize Star Trek lines and never leave the lab, addicted to computer games, and junk food may be driving women away from the field, a new study suggests. 'When people think of computer science, the image that immediately pops into many of their minds is portrait of masculinity that it evokes which repulse girls', the study[28] points out. The attributes and adjectives that we associate with scientific activity, perhaps unwittingly, impinges the perpetuation and reinforcement of gender stereotypes and result in lower participation of women in science.

c) be aware and wary of patriarchal interpretations: History is often depicted as HIS-story. Role of women is blacked-out. Take a look at any illustration or painting depicting humans before Stone Age. While the women are depicted at hearth, surrounded by children, men would be seen to be hunting big game. Women may be slender; men with strong physic. The depictions actually arise not from any evidence, but our unexamined presumptions of fairer sex; and strong male; Man the hunter and so on. The bias gets reflected in the illustrations and imagery that in turn reinforces the prevailing gender bias. The gender roles that we see in the contemporary social world are then seen to be 'natural' which further bolster gender discrimination.

d) go beyond male/female Mars/Venus binaries: pop-science in the contemporary world is full of stories of how men and women differ fundamentally in a non biological sense. Men are Mars and women are Venus is the pithy representation of this view. Often 'studies' would be reported in the public media that girls do bad in maths compare to boys and from that conclude the intellectual differences between men and women. Further, such poorly designed studies are used to assert that certain intellectual capabilities are differently hardwired in the male and female brain, which then goes to reify the gender stereotypes that are prevalent. However careful analysis of these claims will readily show that inter difference are more (if not comparable) to intra- differences. Yet the myth circulates periodically.

The social construct of male/female is so pervasive that we forget that even among humans there are more than two sexes – neuter (including biological hermaphrodites). In fact the cultural construct of male/ female binary constrains us to view, say neuter gendered or differently sex-oriented people as 'deviant' and deem such acts to be 'un-natural' which further leads to criminalisation of such acts. If we look the animal world, more than six sex class has been recorded; with diverse sexuality and sexual orientation. In fact the simplistic notion of a Noah's Ark, with one male and one female specimen sustaining all species, is a far cry from scientific reality. In truth, biological sustenance

[28] Cheryan, Sapna, et.al, Ambient belonging: How stereotypical cues impact gender participation in computer science, **Journal of Personality and Social Psychology**, Vol 97(6), 2009, pp.1045-1060.

and reproduction are dependent upon an incredibly complex web of co-dependent factors, including a third sex. Not only is nature more complex than we imagine, it is more complex than we *can* imagine!