Draw the Line!

International Conference, Copenhagen 2008
Papers, proceedings and recommendations

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Edited by Cathrine Hasse, Stine Trentemøller and
Anne Bjerregaard Sinding

UPGEM Understanding Puzzles in the Gendered European Map

Draw the Line! International Conference, Copenhagen 2008

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Co-ordinator's Foreword

In 2004, six partners-to-be institutions in five European countries, Estonia, Italy, Poland, Finland and Denmark, formed a consortium with the aim of gaining a better understanding of a basic research question: why does statistical data show that we find more female physicists in the southern and eastern part of Europe compared to the northern part? In May 2008, we presented our results at the international conference "Draw the Line!" in Copenhagen.

In the period in-between partners and research assistants have become much wiser – not just on our research question but also on the academic traditions, different values and histories of the partner countries. It has been a fascinating journey into both a Europe and an academic world in transition. We believe our project is part of an important documentation of these rapid and complex changes and we were thus proud to acquaint a larger audience with the results of the UPGEM project in the two publications *Draw the Line! Universities as workplaces for male and female researchers in Europe* and *Break the Pattern! A critical enquiry into three scientific workplace cultures: Hercules, Caretakers and Worker* Bees, at our homepage www.upgem.dk and lastly at the international conference.

The UPGEM partners and research assistants acknowledge they have not accomplished this result alone. Therefore, I would like to thank all the speakers at the UPGEM conference, the researchers and EU-politicians who have visited the project from time to time and been willing to discuss our research with us. These people include:

Lars Qvortrup, Dean of the Danish School of Education, University of Aarhus; Nina Smith, Vice-Rector for academic affairs at the University of Aarhus; Professor Rossella Palomba, Italy; Imbi Tehver, Doctor Emeritus in Physics at the Institute of Physics at University of Tartu, Estonia; Pia Thörngren Engblom, Docent in Nuclear Physics at Uppsala University; Anja C. Andersen, Associate Professor at the Dark Cosmology Centre, University of Copenhagen and Chair of the Network for Women in Physics (NorWiP), Denmark; Jonas Dahl, a Danish politician and member of Parliament; Lisbeth Dons, research assistant in the WOMEN-CORE project at the Copenhagen Institute for Futures Studies; Anne Kovalainen, Professor of entrepreneurship

at Turku School of Economics, Finland; Jens Rostrup-Nielsen, member of the Board of the European Research Council, former Director of the R&D Division and Member of Executive Board at Haldor Topsoe A/S. They have all contributed to this volume. Secondly, we would like to thank Malou Aamund, a Danish politician and member of Parliament; Anu Laas, Professor and Head of Unit of Gender Studies at the University of Tartu, Estonia and Jeffrey Scott Saunders, M.A. International Affairs and M.A. History from Women-CORE for their contributions at the conference. The faculty at the Danish School of Education (DPU) and not least the Culture Team as well as the student helpers who all contributed to the success of the conference. Our thanks must also include all the engaged participants at the conference, who not only contributed by listening but gave new insights and food for thought through very active participations in our workshops dealing with a) University, Management and Workplace Culture; b) Industrial Research at the Mode II University; c) Gender Equality at University as Workplace; d) Science Policy & National Politics; e) Identity & Stereotypes in Natural Sciences; f) Cultural Diversity in the Conception of Work & Family and g) Drop Outs in Physics, other Sciences in Academia and the Private Sector.

Research colleagues at Aarhus University and at other universities in Denmark also deserve a warm thank you for their interest in our project over the years. In Denmark this applies especially to the colleagues in the former 'Gender in Academia' project: Professor Dorte Marie Søndergaard, Associate Professor Lis Højgaard and Associate Professor Inge Henningsen as well as our colleagues Professor Mariane Hedegaard, Professor Seth Chaiklin and Professor Sharon Traweek who have brought valuable insights to the project.

I would furthermore like to give special thanks to Britta Thomsen, Danish Member of the European Parliament, who through her keen interest in the project made it possible for us to present preliminary UPGEM results at the public hearing on 'Women and Science' in The European Parliament, December 18th 2007. Many others should be thanked but the space prevents me. However, I would lastly like to thank our programme officer at the European Commission, Florence Bouvret as well as Delphine Poire and Emmanuelle Causse from the European Platform of Women Scientists (EPWS) for their kind and apposite help with the UPGEM recommendations.

Co-ordinator Cathrine Hasse

Introduction

Cathrine Hasse

Over the next decades the general decrease in the population will affect all sectors of higher education and research in Europe. The natural sciences are encountering increasing problems with recruitment, especially of female physics students. Moreover, it is a matter of utmost concern that well-qualified female scientists seldom reach the same top-level positions as their male colleagues but often leave the research system prematurely. These are facts that have been well documented in a number of studies, notably the SHE figures (European Commission, 2004a; European Commission, 2006), the Helsinki Group Reports (Rees, 2002), the ETAN and ENWISE Reports (European Commission, 2004b; European Commission, 2005; European Commission, 2008), the European Commission (2000), Laurila and Young (2001), Carlson (2000) and Barinaga (1994). Though the overall picture is dismal, an interesting configuration of cultural diversity appears in a gendered map of physicists. It is comparatively easier to attract female students in eastern and southern European countries than it is in the North. Moreover, the career paths of male and female physicists seem to follow different patterns according to national context. The primary objectives in the UPGEM project are to identify relevant local cultural historical processes behind this diversity and to get a better understanding of the "brain-drain" of female physicists, who, more often than their male physicists, never make it to the top even though they possess the same formal qualifications as their male colleagues.

The acronym UPGEM stands for *Understanding Puzzles in the Gendered European Map*[1]. In this project more than 15 researchers from

[1] The project is financed by the European Commission's 6th framework programme "Structuring the European Research Area, Science and Society; Women and Science" and runs from September 2005 to September 2008. The project partners have been: Cathrine Hasse (co-ordinator) University of Aarhus, DPU, Denmark; Kristina Rolin, Helsinki School of Economics, Finland; Anna Maria Ajello, University of La Sapienza, Italy; Endla Lõhkivi, University of Tartu, Estonia, Yrjö Engeström and Merja Helle, University of Helsinki,

Finland, Italy, Poland, Estonia and Denmark have worked together for almost three years in order to address the question why so few women make careers in science in Europe. In this publication, we present papers and proceedings from our conference "Draw the Line!" which took place in Copenhagen May 30–31, 2008. In addition to this publication, we also present results and analyses in the UPGEM national reports (see *Draw the Line!*, and the online *Full Collection of UPGEM National Reports*), in the cross cultural analysis *Break the Pattern!* and in other papers published at www.upgem.dk. In the two days of the conference, researchers, policy makers and politicians discussed UPGEM results and related research.

Part I contains the conference proceedings contributions. The first contribution to this publication is "Women in Physical Science" by UPGEM researcher Lone Svinth. She outlines an array of official statistical data on women in physical science in the EU together with insight into other quantitative data on women in physical science in the EU (with a special view on the UPGEM countries). Svinth also presents a head count[2] illustrating the gender and position of the employees at physics institutes in the five UPGEM countries. The quantitative figures, which are retrieved independent of the qualitative research in the UPGEM project, generally support the arguments of the qualitative research.

The subsequent contributions are based on speeches given at the UPGEM conference "Draw the Line!" in Copenhagen May 2008. A range of international researchers and politicians offered their take on the issues raised by UPGEM and draw on personal experience as either researcher or politician. In order of appearance the contributors are:

Lars Qvortrup, Dean of the Danish School of Education, University of Aarhus with "The UPGEM Conference Welcome Speech". He offers his personal experiences with stereotypes connected to education in Denmark. His three daughters are Ph.D. students in humanities, medicine and organic chemistry, respectively. The discipline of the latter daughter is, as opposed to the two others, always a cause for surprise because organic chemistry (in Denmark) is associated with a strong male culture. Qvortrup also mentions

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Centre for Developmental Workplace Research, Finland and Elzbieta H. Oleksy (until November 2007), University of Lodz, Poland.

[2] The head count was conducted by the research assistants in UPGEM project.

that in discussions of the gender balance in academia a distinction between what he calls 'front stage' and 'backstage' explanations can be useful. Front stage explanations (the official and formal structures) shed no new light on the reasons for the lack of women in natural science. Backstage factors, however, seem to be more relevant, but also more difficult to address and handle.

Nina Smith, Vice-Rector for academic affairs at the University of Aarhus, who, in her contribution "Much Information but Little Progress - UPGEM conference speech", draws on her experiences as board member of private companies in Denmark when she points to the more positive view on diversity management with respect to gender in (some) private Danish companies as compared to that of academia. Moreover, Smith suggests that the tough work environment in physics, as pointed out by UPGEM, might be even worse when looking at humanities and social sciences.

Professor Rossella Palomba from Italy discusses three major stereotyped explanations for the scarcity of women in natural sciences and sheds light on myths and reality in "In the Shadow of Stereotypes". One example is the falseness of the widespread argument that it is only a matter of time before gender equality is the norm in top positions in academia: if the representation of women at the different levels of position continues to increase at the current annual rate, it will take 211 years for Belgium, for example, to reach equality in the A grade.

Imbi Tehver, Doctor Emeritus in Physics at the Institute of Physics at University of Tartu, Estonia, discusses the physics arena in Estonia before and after the collapse of the Soviet Union. In her speech "Closer Look at Estonia from Inside", she also draws new interesting parallels between the mentality in sports and physics.

Pia Thörngren Engblom, Docent in Nuclear Physics at Uppsala University and associated with gender research, stresses that similarities rather than differences between female physicists are striking throughout the world in her contribution "Similarities and Differences in Female Physicists' Professional Lives". A positive factor influencing female physicists' career may be a clear and transparent promoting scheme, as in the case of Turkey. Paradoxically, the advanced social security system of Sweden seem to prevent women pursuing a career as they are expected to and are paid for staying home with their children. Thörngren also draws

attention to support from the management in difficult interpersonal relations as being crucial if one wants to keep women in physics.

Anja C. Andersen, Associate Professor at the Dark Cosmology Centre, University of Copenhagen and Chair of Network for Women in Physics (NorWiP), Denmark, contemplates, in relation to Thörngren's comments, in which of the three types of scientific cultures women thrive best. Moreover, she calls for transparency at all levels of recruiting and employing physicists as well as taking the issue of gender bias very seriously in her talk "When Did We Agree We Were Playing Backgammon Today?".

Jonas Dahl, a Danish politician and Member of Parliament gives "A Take on Possible Solutions to Gender Equality Problems in Academia" in which he among other things suggests more earmarked money to female scientists as in the case of the former FREJA project[3]. He also suggests legislations on earmarked parental leave for fathers – all in order to improve women's possibilities for making a career.

Anne Kovalainen, Professor of entrepreneurship at Turku School of Economics, who in "Knowledge, Institutions and Gender: An East-West Comparative Study 'KNOWING'" offers an interesting comparison of similarities and differences in the research area and findings of UPGEM and KNOWING, respectively. She notes among other things that due to the university changes in all the European countries, the intensification of research activities and the massification of research activities, the career track idea have led to problems both in funding and pipeline issues.

Lisbeth Dons, research assistant in the WOMEN-CORE project at the Copenhagen Institute for Futures Studies, contributes with a paper based on her conference speech "Research or Children? The Grand Dilemma of Female Researchers". Lisbeth Dons discusses a WOMEN-CORE study on women's careers in another male-dominated research field, the construction sector in industrial research. She compares these findings to those in UPGEM.

Jens Rostrup-Nielsen, member of the Board of the European Research Council, former Director of the R&D Division and Member of Executive Board at Haldor Topsoe A/S, presents us with a provocative statement on women in science in his speech "Women in Science. Experiences from

[3] FREJA is a Danish research call addressed at female scientists especially.

Haldor Topsoe A/S & Energy Research Council (ERC)". He argues that women in Denmark lack the driving force which is the reason why we find few Danish women in physics. The women who do make it to the top in physics in Denmark come from abroad. Through his engagement in the European Research Council he sees that women seem to cluster around particular disciplinary fields, such as astrophysics.

Endla Lõhkivi, UPGEM consortium partner and Associate Professor at University of Tartu contributes with "Social changes and changes in science management: the Estonian case" which takes up the issue of social change and discusses painful issues that have appeared in Estonian science management during the period of, and after, Estonian independence in 1991. The discussion is based on the Estonian UPGEM interviews, and Lõhkivi notes that the main problem for Estonian physicists of today is the vague science policy of the nation.

The last proceedings contribution is by Agata Heymowski, UPGEM researcher and cand. scient. anth. In her brief study "Motivation for Physics", Heymowski presents interesting relationships between the UPGEM physicists' motivation for physics and factors like family, teachers, and passion.

Part II presents and discusses the UPGEM recommendations. Together with the UPGEM findings, the conference discussions form the background for the recommendations put forth by the UPGEM consortium in the last part of this publication. The UPGEM recommendations are addressed to policy makers, gender equality officers and decision makers in academia. The recommendations are explained and discussed in connection with the research analyses presented in the UPGEM national reports and *Break the Pattern!* The recommendations are clustered under seven themes: scientific culture, leadership, selection mechanisms, workplace environment, time management, work and family life and science and society. Our overall recommendation aiming at more women and more content researchers in academia propose targeting the often self-evident cultural patterns that create barriers for women in science in order to break these patterns. We end the discussion of the recommendations by correlating these with other discussions and initiatives concerning gender and science taken up by the European Commission.

ANNEXES

Annex I contains a brief review of all the UPGEM National Reports. Here we show that female physicists in the UPGEM countries have many reasons to 'draw the line' and leave physics research in academia due to a combination of push and pull effects. In Annex II we present a chart summarising the salient characteristics of the three types of scientific cultures: Hercules, Caretakers and Worker Bees. The three culture types were first presented and discussed at the conference in relation to our publication *Break the Pattern!* Here the notion of physics *in* culture (i.e. the discipline of physics embedded in and affected by national cultural contexts) was discussed alongside the notion of physics *as* culture, which is defined by the fact that the three types of scientific cultures cut across the national cultural contexts. Annex III presents a table of the percentage of female physics Ph.D.s in nineteen countries around the world. Annex IV is a questionnaire employed in the "Survey Regarding Physicists in Academia". Annex V contains a table illustrating the figures from an UPGEM head count on, among other things, the proportion of women in different physics departments. Finally, we present brief descriptions of the UPGEM partners and contributors to this publication in Annex VI.

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Part I
Conference Proceedings

1.0 Women in Physical Science

Lone Svinth

1.1 Introduction

The existence of valid statistical data is an essential starting point when aiming at qualifying discussions on the representation of women in physical science. The main objective of this paper is mainly to describe existing statistics on the representation of women in physical science in the EU. For that purpose, the paper will provide an overview of two categories of existing data, primarily of UPGEM participant countries:

1) Official statistical data on women in physical science in the EU
2) Other quantitative data on women in physical science in the EU

The first category includes mostly EU statistics or statistics based on a reliable data collection method. The second category includes sources like IUPAP and 'head counts'. The UPGEM made the 'head counts' at selected universities in order to quantify the representation of women in physics. The overall data search was conducted in the fall 2007 and is based on a search in the EU reports and reports made by different networks in physics and researchers. To verify the findings regarding the official statistics I have been corresponding with Eurostat. This paper will primarily relate to the five UPGEM countries: Denmark, Estonia, Finland, Italy and Poland. The project proposal speculated that a North – South and East – West pattern could be found in the context of the representation of women in physical science. The proposal also speculated that there would be relatively more women in physics academia in the southern and eastern countries than in the northern and western EU countries. To test the existence of an uneven distribution of women in different parts of Europe, a control group of nations with quite high proportions of female physicists (UPGEM–2) –

Bulgaria, Hungary, Romania, Slovenia, Spain and Portugal are included in the overview. The paper will also describe a survey launched by the UPGEM project in relation to a Eurostat questionnaire survey on the Career of Doctoral Holders (CDH).

1.2 Official statistical data on women in physics[1]

Unfortunately the official statistics are often at a rather aggregated level and most of the data are on women in *science* in general[2], for example the ETAN Report (European Commission, 2000), The Helsinki Group Reports on Women and Science (Rees, 2002), She Figures 2006 (European Commission, 2006), Götzfried's report on 'Women in science and technology' (2004), Bouvret's presentation in 2007. Most of these reports look broadly at the fields of natural science (mainly following the Frascati manual) which makes it impossible to detect physicists on their own. Official statistics on the representation of women in physics in EU are in other words limited. She Figures 2006 (European Commission, 2006), which contains the widest and most recent collection of European indicators on women and science yet produced, includes only one Table of data on women in physical science (see Table 1). The table presents *educational* statistics showing the representation of females among the Ph.D. graduates within physical science in 2003. On average, 33% among the Ph.D. graduates in the physical science in EU25 in 2003 were women (European Commission, 2006, p. 41). The actual number of female Ph.D. graduates in physics varies

[1] Traditionally science is classified according to either the UNESCO or the Frascati nomenclature. UNESCO has the following nomenclature for Science, Mathematics & Computing: Life science, 42; Physical sciences, 44; Mathematics and statistics, 46; Computing, 48; Engineering and engineering trades, 54; Manufacturing and processing, 54 and Architecture and building, 58. The Frascati Manual uses the following nomenclature: Natural Sciences, Engineering and Technology, Medical Sciences, Agricultural sciences, Social sciences and Humanities. The UNESCO nomenclature is more detailed and therefore more interesting in this regard.

[2] The EU Commission has an overview of publications regarding Women and Science on http://ec.europa.eu/research/science-society/women/wssi/publications_en.html

quite a lot; Estonia had, for instance, only four female Ph.D. graduates in physical science in 2003 (Table 1).

Table 1. The representation of female Ph.D. graduates[3] in physical science in 2003

Country	Female Ph.D. graduates (%)	Country	Female Ph.D. Graduates (%)
Denmark**	***	Austria	21.8 (N=39)
Estonia**	18.2 (N=4)	Czech Republic	28.6 (N=49)
Finland**	39.3 (N=53)	France	34.3 (N=697)
Italy**	45.2 (N=433)	Germany	22.8 (N=745)
Poland**	***	Ireland	52.4 (N=33)
Bulgaria	49.2 (N=30)	Lithuania	28.6 (N=6)
Hungary	37.42 (N=34)	Netherlands	39.9 (N=195)
Portugal	56.72 (N=143)	Slovakia	48.9 (N=68)
Slovenia	34.52 (N=10)	Sweden	32.4 (N=127)
Spain	46.82 (N=444)	United Kingdom	32.6 (N=715)
Romania	***	Turkey	31.7 (N=78)

(Source: European Commission, 2006, p. 41 & p. 83) ** participated in the UPGEM project, *** data unavailable

The representation of female Ph.D. graduates in Southern European countries (Italy, Spain, France and Portugal) are above the EU average, while Turkey is below the EU average. In Eastern Europe the proportions in Hungary, Slovenia and Bulgaria are also above the EU average, while in Estonia, the Czech Republic and Lithuania they are below. In Northern Europe the figure for Finland is above the EU average, while Denmark and Sweden are below. The remaining countries Ireland and the Netherlands are above the EU average, while Belgium, Germany, UK and Switzerland are below. In other words the Eurostat Education Statistics on Ph.D. graduates from 2003 do not show a clear pattern regarding a North – South and East – West distribution of women in physics. With so many exceptions, the statistics only to some extent support the stated hypotheses.

[3] ISCED 6 level

Table 1 is based on educational statistics and therefore does not indicate where Ph.D. graduates are working afterwards. Research would benefit from having disaggregated workplace statistics showing the distribution of male and female physicists in different sectors. Unfortunately the data in She Figures 2006 (ibid.) does not include workplace information on where researchers are working and we do not know the distribution of women in physics academia as opposed to, for example, industry or teaching occupations[4].

Due to the lack of adequate statistical data on the workplace of women in physics in EU, we sincerely welcomed the initiative by Eurostat, OECD and UNESCO regarding the Career of Doctoral Holder (CDH), which will be described below.

1.3 Career of doctoral holders (CDH) in EU

The joint activity initiated from 2004 aims at developing an internationally comparable system of indicators of the career patterns and mobility of doctoral holders in OECD countries. The system is based on the numbers of doctoral holders (both national and international doctoral graduates) in the age range of 25–65 years old. The project has an Expert Group of 40 member countries, which includes Italy and Denmark. To benefit from the CDH initiative three UPGEM countries, Denmark, Poland and Estonia[5], participated in a Eurostat initiated pilot test of the questionnaire (see Annex IV) during 2007 and 2008. The Danish UPGEM team initiated communication between those responsible for the Danish, Polish and Estonian CDH survey. Through collaboration with the Danish CDH team located at Aarhus University, we have had the opportunity to add gender and workplace related questions to the general CDH questionnaire. Through this

[4] EU's Human Resources in Science and Technology (HRST) statistics derive from both educational data and the Labour Force Survey (LFS). In the HRST domain Eurostat extract data by field of education but only on 1-digit level, which is too aggregated for our purpose. The Labour Force Survey breaks the educational level into low/medium/high which again is too aggregated for a project like this.

[5] The other two UPGEM countries, Italy and Finland decided not to participate in this pilot test.

collaboration we got access to data on Ph.D. graduates in physical sciences, which gave us a unique opportunity to look at workplace related similarities and differences between male and female physicists. To enhance this approach we aimed at including a comparative analysis of the other UPGEM countries using the same methodology. We therefore initiated several contacts with the statistical officials in Poland and Estonia in order to make a similar arrangement. Unfortunately we did not succeed since neither of the two countries met either our time-schedule or our requirements regarding the size of the sample. Unfortunately we were unable to get a comparative analysis of the five UPGEM countries, but we do have a Danish survey covering 227 men and women who (partly or fully) got a Ph.D. in physical science in Denmark. Selected results of this survey will be described below in order to show how the CDH concept can be applied in describing similarities and differences between male and female physicists[6].

1.3.1 Result of the Danish CDH survey regarding physical science

The survey includes 227 men and women who fully or partly earned their Ph.D. degree in physical science in Denmark. There is in Denmark a clearly uneven distribution of men (80%) and women (20%) who have earned a Ph.D. degree in physical science.

There is also a clear difference in the age and experience, 36% of the female physicists and 54% of the male physicists earned there Ph.D. degree before 2000, while 64% women and 46% men earned it in or since 2000. Female Ph.D.s have in other words less years of working experience in physical science than men which the age differences between the male and female physicists indicate. The female physicists are also on average younger than their male colleagues (see Table 2).

[6] The target population of the Danish survey has been all doctorate holders living in Denmark on December 31, 2006. The sample included around 5.000 doctorate holders (in all fields). The main source has been the "PhD-register" which included almost everyone who earned a Ph.D. from a Danish university sins the mid-eighties. The survey had a rate of response at around 60%.

Table 2. Proportion (%) of age groups (years)

	28–32	33–37	38–42	43–47	48–52	53–57	>57
Men (N=180)	16	31	24	17	5	5	2
Women (N=44)	36	27	23	5	7	0	3

Table 3 lists the present sector of employment for male and female physicists.

Table 3. Present sector of employment (%)

	Business enterprise sector	Higher education sector	Other education sector	Other public sector
Men (N=178)	40	40	5	15
Women (N=43)	28	44	5	23

Male and female physicists are to a large degree found in the same type of positions (see Table 4). A larger proportion of men than women have indicated “teaching at university” as the present position while more female than male physicists hold positions in biology.

Table 4. Present position (%)

	Women (N=42)	Men (N=174)
Top management	2	5
Physics, astronomy, chemistry, geophysics	50	51
Engineering and architecture	12	10
Biology	12	3
Teaching at university	2	10
Teaching at high school	5	5
Other position	17	16

It is quite rare to find a physicist in Denmark working part time (Table 5). Two thirds of both male and female physicists are in fact working more than full time (37 hours). More male physicists have a working week longer than 45 hours (24%) than their female counterparts (10%).

Table 5. Proportion (%) of weekly working hours

	Less than 37 hours	37 hours	38–45 hours	More than 45 hours
Men (N=156)	1	28	47	24
Women (N=41)	2	27	61	10

In the context of physicists' satisfaction with their present job, the main impression is that in Denmark at least on an aggregated level there are more similarities than differences between the two sexes. In general both male and female physicists appear to have a rather high job satisfaction. Only three out of 13 categories have a proportion of "Somewhat dissatisfied" or "Very dissatisfied" answers above 20% (benefits, job security and opportunities for advancement). Both sexes give the "Opportunities for advancement" the lowest score in this particular question.

Interestingly the female physicists rate their satisfaction with the "Level of responsibility" higher than men. There are no significant differences between how men and women perceive the "Work/life balance" in that 60% of the men and 67% of the women are either "Very satisfied" or "Somewhat satisfied". Both sexes are also quite satisfied with the "Support from colleagues".

Table 6. Gender satisfaction (%) with present job

	Very satisfied		Somewhat satisfied		Acceptable		Somewhat dissatisfied		Very dissatisfied	
	Men	Women	Men	Woman	Men	Woman	Men	Woman	Men	Woman
Salary	20	21	42	42	25	26	11	12	3	0
Benefits	16	14	27	26	34	40	16	19	6	2
Job security	36	39	27	22	17	22	14	12	7	5
Job location	51	53	30	28	12	14	6	5	2	0
Working conditions	34	21	43	55	13	14	8	7	1	2
Opportunities for advance-ment	14	17	26	24	30	33	22	21	7	5
Intellectual challenges	54	63	28	26	12	2	6	9	1	0
Level of responsibility	39	60	38	31	18	9	5	0	0	0
Degree of independence	62	72	28	28	6	0	3	0	0	0
Support from colleagues	40	43	37	31	16	17	7	7	0	2
Work/life balance	23	23	37	44	31	23	7	9	2	0
Contribution to society	25	35	49	49	23	12	3	5	0	0
Social status	29	42	43	40	22	16	6	0	1	2

Even though both male and female physicists in general seem to be satisfied with their job, 44% of both male and female physicists have either "very much" or "partly" considered finding a new job within the last six months. A key characteristic of the Danish labour market is the high level of worker mobility (Eriksson & Westergaard-Nielsen, 2007). Out of a total workforce of 2,875,000 – 800,000 positions are occupied every year. In this respect, the general Danish labour market resembles the American labour market more than the other European markets (Ministry of Science Technology and Innovation, 2008).

Table 7. Proportion (%) of physicists seeking work in the previous six months

	Job has terminated	Yes – very much	Yes – partly	No
Men (N=178)	5	11	33	51
Women (N=43)	5	14	30	51

Those physicists who indicated that they were considering finding a new job were asked to indicate specific reasons for those considerations. Both male and female have "Opportunities for advancement are lacking" as one out of three of the most frequent stated reasons for considering finding a new job. Table 8 lists the percentage of physicists who indicated that the stated reasons in question 14.1 was "decisively important" or "very important" for their considerations. Please note that only 18 women answered this question.

Table 8. The most important factors in considering new employment

Women (N=18)	Men (N=77)
Want better working conditions 44%	Opportunities for advancement are lacking 45%
Opportunities for advancement are lacking 33%	Want more responsibility 38%
Want better job security 28%	Want better pay 39%

Table 9 by contrast lists those topics which most physicists found unimportant in their considerations.

Table 9. Factors which physicists did not consider important when considering a new job

Women (N=18)	Men (N=77)
Lack of research funding 72	Demands of the job are to severe 43
Want a larger degree of independence 56	Hours required are too long 38
Want a better work life balance 50	Lack of research funding 30
Hours required are too long 50	Want a larger degree of independence 29
Want a more prestigious position 50	Want a more prestigious position 26
Demands of the job are to severe 50	

Interestingly both sexes seem to pursue a career in research for the same reasons. For both sexes the two most important reasons were the *creative and innovative aspects of the profession* and the *degree of independence* (see Table 10).

Table 10. Why did you choose a research career? – Prioritized order women and men

Women (N=44)	Men (N=180)
Creative and innovative aspect of the profession 63%	Creative and innovative aspect of the profession 84%
Degree of independence 55%	Degree of independence 65%
Support/encouragement from other researcher 34%	Contribution to society 26%
Working conditions 20%	Working conditions 18%
Contribution to society 18%	Support/encouragement from other researcher 16%
Work/Life balance 11%	Work/Life balance 9%
Good opportunities for advancement 9%	Good pay 8%
Good pay 5%	Good opportunities for advancement 7%
Only job opportunity 5%	Job security 4%
Job security 2%	Only job opportunity 3%
Benefits 0%	Benefits 2%
Family tradition 0%	Family tradition 2%

Among physical scientists who do not work as researchers, there are no women who state that poor pay is the reason for not working as a researcher. However, almost a third of the men do give this reason for not working in research. Preston (2004) finds the same pattern of a larger proportion of men than women who indicated poor pay as a reason to exclude a career in research.

A large majority of men (85%) and women (82%) are married or are cohabiting, which is well above the average for Danish adults (see Table 11).

Table 11. Marital status of physicists

	Married/cohabitant (%)	Single (%)
Men (N=179)	85	15
Women (N=44)	82	18

Male physicists are more likely to have children than female physicists (see Table 12).

Table 12. Proportion of physicists with children

	Age 0–5		*Age 6–18*	
	1 or 2	>2	*1 or 2*	*>2*
Men (N=130) (*N=122)*	52%	5%	*48%*	*8%*
Women (N=34) (*N=29)*	35%	0%	*21%*	*17%*

Male physicists have on average a larger annual income than female physicists. Indeed whereas 38% of the male physicists have an annual income on 68, 000 Euro or more, this only applies to 15% of the female physicists (see Table 13). In the context of age differences, some

differences in income should be expected, but as head counts indicated female physicists are primarily found at the lower career levels at the Danish Universities. This probably explains some of the differences in annual income for women in physical science.

Table 13. Individuals' (%) gross annual income (€) in 2006

	< 46k	47–54k	55–67k	68–80k	81–107k	>107k
Men (N=170)	9	24	29	18	12	8
Women (N=42)	17	19	50	10	5	0

k = thousand

The Danish material reveals some interesting findings and illustrates the importance of statistical data on a disaggregated level. However, a lot of issues and data from this survey are left unresolved because the aim of UPGEM is to have a broad and balanced focus on several countries. The material also reveals some of the analytical limitations of small samples. Due to the relatively small size of the female sample, detailed statistical analysis were not possible. One of the aspects we have left unresolved in this respect is the question of similarities and differences across employment sector and sex.

1.4 Unofficial statistical data on women in physics in EU

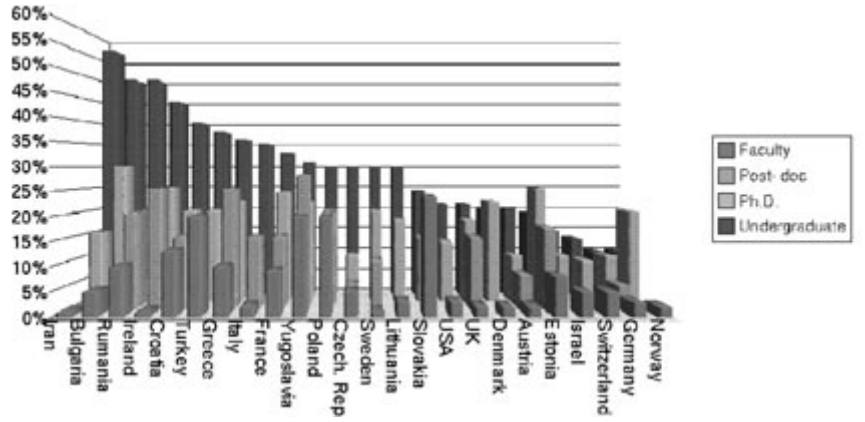
Several attempts in physics society have been made to calculate the representation of women in physics. In 1990, Jim Megaw, former Chairman of the Physics Department at York University in Ontario, Canada, made an empirical study of universities around the world to obtain data about the participation rates of women in physics (Barinaga, 1994, p. 1468). The study was reported on "Gender Discrimination in the World's Physics Departments" at the Gender and Science and Technology meeting in Australia in 1991 but has never been published. Megaw's study is one of the few that compares the representation of women in specific scientific

disciplines around the world[7]. According to Barinaga (ibid.), Megaw sent a questionnaire to more than 1000 physics departments, asking what proportion of their faculty and students were women. Megaw received replies from 400 departments, a response rate of below 40%. The relatively low rate of response should be taken into consideration when referring to the survey. Megaw's survey showed, according to Barinaga (ibid.), that some of the most industrialized countries had the smallest percentage of women physics faculty. The 10 countries with the *largest* female representation in physics faculty (by percentage) included Portugal, Italy and Turkey (with Spain and France in 11th and 12th place) and two Eastern European countries Hungary and Poland. According to Barinaga (ibid.) countries with large physics establishments, high levels of industrial development, and strong women's rights movements provided six of the 10 countries with the *smallest* female physics faculty percentage: Canada, Germany, Norway, USA, UK, The Netherlands and Denmark.

The American Institute of Physics conducted, in 2005, their own analysis of "Women in Physics and Astronomy" (Ivie, Guo & Ray, 2005) with figures from both the US and selected EU countries on the number of Ph.D. awarded to women in physics (see Annex III). The figures in "Women in Physics and Astronomy" are not comparable to those in Table 1 cited above from Eurostat. The tables reveal quite a disparity with Eurostat having generally higher figures than Ivie, Guo & Ray. Also the International Union of Pure and Applied Physics (IUPAP) collected data for the conference on woman in physics (see Table 14). The Table gives a diverse picture of the representation of women in physics in different countries. Also the International Union of Pure and Applied Physics (IUPAP) collected data on woman in physics at the IUPAP Conference in Paris in 2002. The chart gives a diverse picture of the representation of women in physics in different countries and no clear North – South and East – West pattern emerges.

[7] According to PHYSNET, facilitated by European Physics Society (EPS) there are more than 1700 physics departments worldwide (http://www.physnet.de/PhysNet/physdep.html).

Table 14. Percentage of women in physics, Europe/USA[8]



(Source: IUPAP, 2001)

1.4.1 UPGEM survey on women in physical science academia

In May 2007 the Danish UPGEM team launched an internet survey based on an edited version of the CDH questionnaire (see Annex IV). The aim was to compare the Danish CDH survey described earlier with identical surveys in the other UPGEM countries. The questionnaire was sent to 1856 physicists working at universities in Poland, Finland, Estonia and Italy. The survey was active for two months. Two reminders were sent in that period. See Table 15 for the response rates.

[8] The method used in this survey is quite different from the other two surveys cited. According to my personal correspondence with Karoline Wiesner who compiled the data, she contacted the team leaders from every country and asked them for statistics for their respective country. Wiesner suggests that the data in the graph are either from their personal judgment or sources unknown to Wiesner.

Table 15. Rates of response – UPGEM survey on women in physics academia

	E-mails sent	Undelivered* e-mails	Replies	Response rate (%)
Poland	855	35	180	22
Finland	311	7	67	23
Estonia	255	13	67	28
Italy	435	73	83	23
TOTAL	1856	128	397	21

(The figures in the Table do not include the unknown number of emails expected to have been caught in spam filters.)

The rates of response were between 22–28% which is very unsatisfactory. We have discussed how to increase the rates of response but have declined to use an award or gift. We also did not find the survey suitable for a telephone follow up (because the survey contains sensitive questions). We therefore concluded that the survey cannot be used quantitatively to detect culturally related differences and similarities between physics institutions in the selected EU countries.

1.4.2 UPGEM Head count from university homepages

UPGEM's research assistant managed a 'head count' in autumn 2006 at the UPGEM seminar in Estonia. The 'head count' is based on information available on the universities' homepages. Since the seminar attendees conducted the head count together, we could discuss in plenum the many questions that arose during the process and were able to some extent to ensure that the same categorizations were applied. These discussions primarily concentrated on categorizing the various job titles. For each of the universities where UPGEM researchers conducted interviews, the research assistants gathered available information on the physicists employed at the university (e.g. sex, position, highest educational degree and research field, temporary or permanent employment). We have excluded those names where we could not verify the person's sex or position. We have also excluded research assistants without a Ph.D. degree but we have included visiting researchers and other temporary employment

as long as we were able to categorize their position according to the Tables below. There are obvious limitations to this kind of method. First, not all university homepages are up to date which means that physicists who have left are still visible while newly employed physicists are not visible. Also the positions that physicists hold could be wrong or missing. Even more importantly we found that the five countries are applying very different classification systems regarding research positions which make a comparative analysis quite difficult (at our homepage www.UPGEM.dk, the fact boxes describe how the classification system in each country). In SHE Figures 2006 (European Commission, 2006) Eurostat apply an employment structure of three grades where 'A' is the highest post at which research is normally conducted – equivalent to 'Professor'. Grade 'B' covers researchers working in positions junior to Grade 'A', but more senior than newly qualified Ph.D. holders – equivalent to 'Associate Professor'. Grade 'C' is the first post into which a newly qualified Ph.D. graduate would normally be recruited – equivalent to 'Post Doctoral' or 'Assistant Professor'. We also decided to include technical positions where the employees have a Ph.D., since at least some of the UPGEM countries have a tradition for applying this category in physical science. At some of the universities there is a discrepancy between the overall head count and the distribution of researchers according to their position at the university. This discrepancy occurs because the two set of tables were not generated at the same time. As a result there might be changes which occur on one list but not in the other. Also it has not been possible to detect the job positions for all the researchers which mean we have omitted several researchers from the list.

Table 16. Head count at physics departments in Denmark

	Men	Women	Total	Women (%)
Technical University of Denmark	81	12	93	13
Niels Bohr Institute, University of Copenhagen	229	54	283	19
Roskilde University Centre	10	2	12	17
Aarhus University	157	24	181	13
TOTAL	477	92	569	16

In Denmark 28% of all researchers in all fields at the 10 universities are women (Langberg & Lauridsen, 2001), implying physics is a discipline with relatively few women (see Table 16). When we disaggregate the figures and look at how the distribution of women correlates to job titles we find that women in both absolute and relative terms are primarily found in Ph.D. student positions. According to this 'head count' only one of the four universities in Denmark has female professors. Since the pool of female assistant professors and female associate professors is relatively small, this situation is unlikely to change dramatically within the next few years.

The representation of women in physical science in Finland is also relatively low (see Table 17) and as in Denmark women are primarily found in Ph.D. student and Post Doctoral positions (see Table 18). Although all universities have female professors even though the numbers are small (see Table 19).

Table 17. The proportion of women at different levels of research positions in Denmark

Denmark										
	Ph.D. student		Post Doctoral		Assistant Professor		Associate Professor		Professor	
University	Women	%	Women	Pct.	Women	%	Women	Pct.	Women	%
DTU	5	14	3	14	0	0	3	17	0	0
NBI	30	31	10	22	2	22	7	10	2	4
RUC	0	0	0	0	0	0	2	24	0	0
Aarhus	14	22	4	12	2	10	1	2	0	0

Table 18. Head count at physics departments in Finland

	Men	Women	Total	Women (%)
Helsinki University	220	63	283	22
Helsinki Dep. Hip	79	15	94	16
Oulu University	93	24	117	21
Jyväskylä University	113	19	132	14
TOTAL	505	121	626	19

Table 19. The proportion of women at different levels of research positions in Finland

Finland												
	Ph.D. student		Post Doctoral		Assistant Professor		Associate Professor		Professor		Technical staff	
University	Women	%	Women	%	Women	%	Women	%	Women	%	Women	%
Helsinki*	48	25	13	21	3	14	4	13	5	9	1	17
Oulu**	17	30	2	13	0	0	3	16	1	6	0	0
Jyväskylä	11	15	6	23	0	0	0	0	1	8	1	100

* Includes both Helsinki University and Helsinki Dep. Hip Three women with unknown titles were excluded from the Table.

** One woman with unknown title was excluded from the Table.

In Estonia the physics related university/research institute departments are relatively small. Interestingly Tartu University, which has the biggest number of physicists, has the smallest representation of women (see Table 20). Women are to a large degree concentrated at Ph.D. student level and two out of the four universities/research institutes do not have female professors (Table 21).

Table 20. Head count at physics departments in Estonia

	Men	Women	Total	Women (%)
Tartu Observatory	67	18	85	21
Tartu University	206	38	244	16
National Institute of Chemical Physics and Biophysics	41	10	51	20
Tallinn University Of Technology	45	9	54	17
TOTAL	339	70	409	17

Table 21. The proportion of women at different levels of research positions in Estonia

Estonia												
	Ph.D. student		Post Doctoral		Assistant Professor		Associate Professor		Professor		Technical staff	
University	Women	%	Women	%	Women	%	Women	%	Women	%	Women	%
Tartu Observa.	4	40	0	0	2	12	3	18	0	0	0	0
Tartu University	11	28	0	0	7	20	5	9	0	0	3	21
National Ins. Of chemical physics and biophysics	1	20	0	0	5	36	2	13	1	25	0	0
Tallinn University Of Technology	7	24	0	0	2	33	0	0	1	20	0	0

In Poland there are relatively more women in physical science than in Denmark, Finland and Estonia (Table 22). Even though the female physicists are concentrated at the Ph.D. level as in Denmark, Finland and Estonia there in general seems to be a larger representation of women across the different positions in Poland. All the listed universities have female professors (Table 23).

Table 22. Head count at physics departments in Poland

	Men	Women	Total	Women (%)
Warsaw University	268	78	346	23
AGH Academy – Krakow	35	24	59	41
Poznan University	213	95	308	31
Lodz University	86	23	109	21
Jagiellonian University	248	63	311	20
TOTAL	850	283	1133	25

Table 23. The proportion of women at different levels of research positions in Poland

Poland												
	Ph.D. student		Post Doctoral		Assistant Professor		Associate Professor		Professor		Technical staff	
University	Women	%	Women	%	Women	%	Women	%	Women	%	Women	%
Poznan	44	48	1	14	35	32	1	5	8	14	0	0
Warsaw	39	32	1	100	20	15	4	15	8	17	1	25
Krakow	9	75	0	0	5	31	2	50	4	29	0	0
Lodz	6	24	0	0	6	40	5	15	1	14	0	0
Jagiellonian	35	34	2	25	2	22	13	13	2	4	0	0

Italy has the highest proportion of women physicists (27%) of the UPGEM countries (Table 24).

Table 24. Head count at physics departments in Italy

	Men	Women	Total	Women (%)
Rome INAF-IASF	60	33	93	35
Bari University	74	25	99	25
Genova University	101	34	135	25
INGV Rome	64	53	117	45
Napels University	235	56	291	19
Udine University	16	6	22	27
La Sapienza+INFN Rome	202	75	277	27
INFN Rome	46	12	58	21
TOTAL	798	294	1092	27

*Table 25. The proportion of women at different levels of research positions in Italy**

Italy												
	Ph.D. student		Post Doctoral		Assistant Professor		Associate Professor		Professor		Technical staff	
University	Women	%	Women	%	Women	%	Women	%	Women	%	Women	%
Bari	4	31	0	0	16	41	0	0	5	11	0	0
INGV Rome	4	36	1	100	6	75	29	48	10	34	4	44
Napels	11	31	6	32	20	17	16	12	5	8	0	0
Udine	2	50	0	0	2	25	0	0	2	40	0	0
La Sapienza +INFN Rome	15	58	15	42	12	24	23	38	3	8	0	0

* Not all the above mentioned universities are listed in Table 24 due to difficulties with the categorization.

The distribution of women physicists does not vary that much from one university to another, especially in Denmark, Finland and Estonia. The relative distribution is more widely spread in Italy (Table 25) and Poland (Table 23). In both Denmark and Finland women have a relatively large representation at the largest university, while in Estonia, Poland and Italy

women physicists generally have a lower representation at the largest universities.

Table 26 shows the representation of women at the different research positions at the selected universities in the five UPGEM countries. Women in general are found primarily at the entry level as Ph.D. students. Italy stands out as the country with the relatively largest representation of women along the later career path in the five countries. The concentration of women at entry positions is in other words smaller in Italy than in the other UPGEM countries. Even though there is a relatively large variation between the Italian universities the overall picture is that there are more female professors in physics academia in Italy than in the other UPGEM countries.

Table 26. The proportion of women at different levels of research positions in the five UPGEM countries

	Ph.D. student		Post Doctoral		Assistant Professor		Associate Professor		Professor	
Country	Total	Women %	Total	Women %	Total	Women %	Total	Women %	Total	Women %
Denmark	199	24	100	17	36	11	135	10	79	3
Finland	325	23	102	21	48	8	51	12	82	9
Estonia	84	27	4	0	72	22	95	11	30	7
Poland	355	37	22	18	281	24	183	14	175	13
Italy	89	40	35	34	219	26	177	33	180	23

In Annex V, the representation of women physicists is listed according to the departments/institutes/ research group where they are working.

1.5 Conclusion

To understand the situation of women in science academia in general and women in physical science in particular we need both quantitative and qualitative analysis. The Danish pilot test of the Eurostat survey on the

Career of Doctoral Holders reveals some interesting findings regarding the similarities and differences between men and women in physical science. We strongly recommend that Eurostat publish data on a disaggregated level when the CDH concept is launched through out EU. We also recommend that EU include some of the workplace specific related issues from the Danish pilot test in their questionnaire concept. Simple head counts like those we made in UPGEM are interesting but they can never replace in depth analysis and should be considered second best solutions.

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2.0 The UPGEM Conference Welcome Speech

Lars Qvortrup

The UPGEM project focuses on the distribution of and the opportunities for female and male researchers in academia. As a starting point, the rhetorical question 'do we have problems concerning the distribution of male and female researchers in higher education and in academia?' has a clearly positive response.

Let me provide you with two examples:

1.
My university, Aarhus University, has approximately 280 professors, of whom 250 are male and only 30 female. The pattern is different, almost one of parity, for Ph.D. students: 310 male and 290 female. Nevertheless, among the nine faculties at Aarhus, the Faculty of Natural Science is different with almost twice as many male Ph.D. students (120) compared to females (60). So, at Aarhus University, women are not attracted by physics.

However, I cannot resist mentioning that my own faculty, the School of Education, partly redresses the balance. We have 10 male and 10 female professors, and 11 male compared to 24 female Ph.D. students. This, nevertheless, is an exception to the general rule.

2.
Using the context of an even more 'private' example, I would allow myself to mention my own family. I have three daughters who are all Ph.D. students. Their distribution among the faculties is broad: One is a Ph.D. student within the humanities, the second studies medicine and the third studies organic chemistry.

So, what is the issue? Let me provide you with two examples: Firstly, when I as a proud parent tell people about this, they always focus on my third

daughter: Organic chemistry? Laboratory work! In Denmark, this still seems to be associated with strong male cultures. Secondly, Ph.D. students are expected to go abroad for one semester. But how can you manage to do so with a new-born son and a husband in the early stages of his – very important – career; and with little opportunity to take the whole family to Australia or the US for four months?

Behind these examples a number of general questions emerge: What influences the choice of education? Why are patterns concerning female students in physics so disparate in different European countries? Why are Italian women considerably more attracted by physics than for instance women in Denmark? These questions are of the utmost importance. We cannot afford not to attract all people and all sexes to all faculties. It is a matter of equal opportunities.

I have studied some of the publications from the UPGEM project and have been strongly stimulated by the findings. It is obvious that concerning the distribution of sexes in academia we can make a distinction between what we could call front stage and backstage explanations. The front stage explanations focus on the 'official' and 'formal' structures: education, recruitment, gender policies etc. But what about the backstage factors? They seem to be even more important, and more difficult to manage and influence.

A number of 'cultural stereotypes' or 'cultural truisms' have been identified in the UPGEM project. And I do agree in the general method: What is natural and obvious in Denmark is not necessarily so in other countries. Therefore, comparative international and inter-cultural studies are a way to change a cultural truism into being a cultural bias. Let me just mention three of these stereotypes that have been identified in the study:

1. The stereotype of family and solidarity: Who is responsible for the upbringing of children? In Denmark it is the parents – with a strong focus on the mothers. In other countries the family solidarity structure is much broader, including grandparents and even other parts of the extended family.
2. The stereotype of cultural history: In Denmark the relationship between science and the humanities is a relationship between two totally different cultures; a strong and a weak culture, hard and soft sciences, male and female cultures. In other countries, however, it is

different, because they are both rooted in a common cultural history. And this certainly influences the opportunities for male and female students.

3. The stereotype of working conditions and cultures: I can assure you that there is a world of difference between the Ph.D. student in humanities and in chemistry. One works alone in her office, meeting with her colleagues in the coffee break. The other works in the laboratory from 8.30–17.30.

Therefore, I strongly support the findings of the UPGEM project. It is politically and economically important, because a knowledge society is a society with equal opportunities, including equal knowledge opportunities. But it is also important from an intellectual point of view, simply because I am thrilled with the unexpected findings of causes and patterns of academic career selection.

However, the most important aspects are: What works? How can we change the unequal distribution of opportunities? Of course, there are a number of things that we can do in the front stage area, but what can we do back stage concerning the cultural stereotypes? I do agree to the suggested UPGEM recommendations that it is not a problem for and of women, but a problem concerning workplace cultures in general.

3.0 Much Information but Little Progress – UPGEM conference speech

Nina Smith

My own background for having a strong interest in and some knowledge about women in academia started in the 1970s when I was a student at the Department of Economics at University of Aarhus. Later on, I ended up as a researcher within the field of 'economics' which in Denmark has been an almost 'women free environment'. I have done research on women's careers in the labour market in general and women in top management and business performance. I have also been a member of the Equal Opportunity Council at University of Aarhus, sat on government expert groups on women in academia, participated in several conferences on gender in academia, and I have been linked to a research programme on 'Gender in academia' at the University of Aarhus (funded by the Danish Research Council).

I mention my long career as a participant in 'gender-in-academia' issues because the main thing I want to stress is four lessons I have learned during my long experience within academia:

In general, we *do not lack information* about the mechanisms with respect to the absence of women in academia, the 'leaking pipeline' and all that – we have lots of analyses. I still think the UPGEM project is interesting because it digs deeper into some of the mechanisms within one scientific area, physics, in an international perspective, and this is valuable new information.

Despite all the reports, all the analyses etc., almost *nothing has happened* during the last 20 years with respect to women in permanent research positions (i.e. associated and full professors). I do *not* believe in the hypothesis that things will change eventually because half of the students are now women, and women perform well in the educational system etc.

Nevertheless, in Denmark we still have a well documented 'leaking pipeline'!

During the latest decades, women wrote about 30–40% of all our Ph.D. theses at Aarhus University, but almost nothing has happened to the proportion of female professors which is still about 10% (it has increased somewhat after the recent merger of the School of Education (DPU) and the Aarhus School of Business).

But "*times are a-changing"* – to quote Bob Dylan: In the private sector we see a tight focus on recruiting talent and in diversity management; a trend that is supported from my experience from being on the boards of a few private firms. My impression is that in the most progressive Danish private firms – not all private firms – there is a much more positive view on diversity management with respect to gender and ethnicity. In academia I also think times are changing – maybe as a response to the development in the private sector. Male professors have become aware of the increase in the number of very clever women who want to make a career. Maybe it is because some of these male professors now have adult daughters who are trying to make their own careers, and these daughters are of course extremely clever and competent. This is probably the first generation of male professors, or CEOs in big firms, in history who have this experience and I think it is important.

Finally, there is much more focus than earlier on *family policies*, career issues, the allocation of time in the household and spouse employment, maternity and parental leave issues etc. These issues are not only important in relation to female researchers, but also important in relation to young male researchers. In general, I am very positive with respect to the UPGEM recommendation that career problems in academia should not be viewed as 'women's business' but a general workplace issue.

Therefore I think that the results from the UPGEM project are extremely interesting. The UPGEM project analyses women in one specific academic field, physics, in a number of countries. It documents that the academic job market is an extremely competitive job market; local cultures are tough. This applies especially to those who want to have a family, but even more so if you are a woman who does not succeed in finding a man who can fill out the role as a 'traditional housewife'! Very few women succeed in this! And actually, there are also many young male researchers today who are

not married to a housewife although research shows that men in academia more often are married to women with a lower level of education compared to the spouses of female researchers.

The results outlined in the UPGEM publication *Draw the Line! Universities as workplaces for male and female researchers in Europe* are actually in line with the results of a study made at the University of Aarhus in March 2005. The title of the Aarhus report, *Last Man Standing*, indicates the results from the study,– academia is a bit like a 'wild west world', a 'Hercules world', where the strongest, not necessarily the best survives:

- Working conditions are tough – long working hours (but also a flexible job where you are able to work during nights and weekends – often at home with your children). This also means that you may feel you should always work – leisure time and work are mixed up and this may imply stress and the feeling that you never work enough.
- The culture may also be tough – not open discrimination but very critical and in some areas a very lonesome culture if research work is not organized in teams.
- Academia often lacks openness and transparency with respect to recruitment procedures – it is not direct or intended discrimination, but the mechanisms work in practice like discrimination.
- Internationalization is a real barrier for women who have children – six months abroad without the family is not attractive or is impossible and it is not as easy for female researchers to get their husband to take up paternity leave as it is for male researchers to get their wives to do the same.

The *Last Man Standing* report analysed all faculties at the university ('the old university'), including social sciences, medicine, natural science and humanities. The results indicated that the culture is even worse in social science and humanities, compared to natural science and medicine where working in research teams is much more common. Thus, if we generalise on the UPGEM project, I expect that your results would be even stronger if you had analysed all the faculties at Aarhus University or other Danish universities.

I will not list all the main UPGEM results from the national reports; we know them and it is extremely good to have them documented. Instead I would like to turn to policy – and what we can do about it! I think we need to completely renew the discussion and rethink the policies if we really

want to change the data concerning gender in academia. The discussion on female professors and gender in academia has focussed on academia as a special labour market where special instruments should be applied. We have discussed quotas for more than three decades – maybe longer, and we have not succeeded in really changing anything using this instrument. Quotas do not work in Denmark! They seem to work in Sweden and Norway and now maybe in the EU. But I do not believe in quotas for the case of Denmark (and I want to stress that I do not mind quotas personally). But the Danish debate on gender is different – some might say a bit 'stone-age-like' compared to many other countries, even countries in the South of Europe.

The good thing is that I do not think we need quotas in Denmark in order to change the gender balance any more. There is an open window now for changing things by applying more general instruments that assist in professionalising human resource policies and practices relevant for both women and men. These are mentoring and talent nursing policies, transparent and fair recruitment processes, family policy, child care, and workplace culture etc. This is exactly the same type of policies that you can now find in many private firms!

I do not think that the challenges to recruit and nurse talent or to recruit more female professors etc. are very different in the academic labour market compared to the private sector. Instead of discussing gender quotas and gender policies we have decided at the University of Aarhus to copy what the best firms in the public and private sector do with respect to recruiting talents. Therefore, we have signed the charter for more women in top management which was recently launched by the Minister of Equal Opportunities (see www.kvinderiledelse.dk). Among other things, this charter requires that the university works with a workplace culture and professional Human Resources. We did not have any prior knowledge of the UPGEM results when we made this decision, but I think that the results in the UPGEM project support this strategy and we will surely look further into the recommendations of the project.

4.0 In the Shadow of Stereotypes

Rossella Palomba

4.1 Still an unequal science

Although there have been major advances, academic and research institutions are still not fully using the pool of women scientists they have produced. Moral and legal imperatives to ensure equal opportunities provide enough reasons to examine the causes of the disparities and to try to correct them. Equally compelling is the impact that gender imbalances have on the efficiency and excellence of our universities and the competitiveness of Europe.

For years gender has been a neutral factor in the context of academic excellence. Moreover, research has rarely, and only recently analysed gender differences, gaps in scientific careers, research outputs, earnings and funding in terms of gender discrimination or lifestyle trade-offs. Physics is among the most male-dominated disciplines. At EU level we have an average of 9% female physics professors which does not even come close to equal representation of gender in the field. The low number of women trained in physics is partially to blame for the shortage of women in the faculties. Therefore, society should encourage young women to enter physics as well as in all the traditionally male dominated disciplinary fields. Programs and actions designed to prepare students to enter scientific careers can provide access to role models and may inspire confidence and commitment. But these actions are effective only without gender bias in the scientific sector.

Without much objection, gender bias in science is put under the label of stereotypes which offers an explanation to existing gender differences in science. In addition, EU-wide sparse policies on maternity issues, childcare and sexual harassment at the workplace do little to promote women to senior positions and even discourage women to aim for them.

But is it true that women in science are discriminated? Can we prove that the under representation of women in the science sector is the outcome of gender discrimination? Let us examine the major stereotyped explanations for the scarcity of women at the top of the academic and scientific hierarchy, offsetting them on the basis of objectivity.

4.2 Myth or reality?

In science there are three major common stereotyped explanations for the scarcity of women at the top of the hierarchical ladder.

1. Stereotype 1: "Women have to be patient and wait. The phenomenon of their under-representation at the top of the scientific hierarchy will naturally disappear over time as their numbers increase at the entry level"
2. Stereotype 2: "The family and children are a handicap for female scientists, because science is a totally demanding job"
3. Stereotype 3: "Women publish less than men; it is therefore normal that they fail to get top positions".

Stereotype 1

The simple description of the lower percentage of women in the higher career levels is not enough to explain the existence of injustice in the mechanisms of evaluating merit in science. In fact, because of the noted increase in the access to science of younger women, there is the possible argument that it is simply a matter of time before women achieve gender equality. Let us start by saying that if women have to wait patiently for their turn to have a more equitable career structure they should be prepared to wait for ages.

For example, in France this would require waiting for at least 5,980 full professors to retire. Including all the EU countries, more than 30% of the male full professors would need to leave their chairs to women. Also at the all EU level, women would need to replace 31,305 grade A male professors to achieve equality purely quantitatively speaking. Temporally, in Belgium,

at the current annual growth rate in the proportion of women at different grades, it will take 40 years to reach equality in the C grade, 140 years in the B grade and 211 years in the A grade (de Henau & Meulders, 2001). At current growth rates of full professors in Italy, equality between the sexes in the A grade could be reached in 79 years.

A study in Italy suggests that in the context of all the factors being constant women have a lower chance of being promoted to upper grade. For example, after 11 years at grade B women have a 16% chance of being promoted, whereas their male colleagues have 39% chance (Palomba, 2000). Thus, it would be absurd to suggest that waiting for equality is enough when the evidence suggests that the length of the wait would be unreasonably long. Besides, even a short wait would be symptomatic of the patronising attitude towards the question of women's participation in science. To be patient and to wait for equality is wasting time.

Stereotype 2

Even in the most flexible working environments, of which science is not, careers and promotions in highly professionalised jobs require major investments in terms of time, availability and geographical mobility. All these aspects may be hard to reconcile with family commitments, which are still largely left up to women. One may wonder if the demand for total dedication to work is really necessary for the proper functioning of scientific work and its positive outcome, and indeed, if this is really gender-neutral. In fact, men who do not climb the career ladder are never interpreted as having made 'a choice' with respect to other social dimensions in their lives. Nor does anyone seem to wonder if successful male scientists have been confronted with the same 'choose-or-lose' dilemma of either having a family and children or striving to achieve a top position in science.

The choice of not having children may have more symbolic value than concrete effect on careers. Empirical studies do not show any evidence that not having children will produce positive results in terms of climbing the career ladder. In EU countries, data concerning marital status and the number of children of male and female researchers are very fragmentary. Those studies which have been undertaken by disciplinary associations,

personal initiatives by women researchers, contingent curiosity, and interest do not allow for cross-national comparisons. However, the evidence suggests three different hypotheses about the existing gender relationships between family, children, and scientific profession:

a) Women scientists enjoy less family life than men scientists in at least several countries
b) Women scientists are internalising the costs of their reproduction by deciding not to have children.
c) Successful men are supported by their family; the presence of children has little or nothing to do with their career opportunities.

Stereotype 3

One of the criteria widely used by the scientific community to evaluate the competence and professional ability of researchers is the quantity of scientific productivity. Publications and patents are the usual measurements. A frequent explanation is that a correlation exists between scientific productivity and access to top careers; women publish less than men therefore they have less access to the highest positions.

Studies have shown that women need to be twice as productive as men to be considered equally competent (Wennerås & Wold, 1997). An analysis of scientific productivity was carried out in two Italian institutions (CNR-National Research Council and INFM - National Institute for Physics of Matter). Women appear to publish less than men but it is worth noting that there is no significant gap in Impact Factor values between men and women. The overall average Impact Factor is 1.82, and is very similar for men (1.83) and women (1.77) (Palomba, 2000).

4.3 What to do?

People tend to apply themselves to promote issues that they believe are important to the organization within which they perform. To do so they engage in ‘issue selling’, in pursuit of calling the organisation’s attention to facts or events that impact on organisational performance. Through ‘issue

selling' individuals become part of the organisation´s collective awareness. 'Issue selling' is dependant on the assessment of the seller of the appropriateness of the issue to be sold within the organisation. In fact, selling the right issue at the right time can generate favourable career benefits. But selling an issue that is controversial or costly for the organisation can potentially damage the seller's reputation. Selling an equal opportunity issue within an organisation is in general not easy; it is even more difficult in science, and in physics in particular, where the top positions are predominantly held by a male audience. Equal opportunities and gender mainstreaming are in fact rarely perceived as a strategy by university management, and Deans and Rectors find it difficult to admit the existence of gender bias within their organisations.

Women alone cannot do everything; we need political attention and empowerment. As EU Ambassador for Equal Opportunities in science, I visited many schools and labs. I understood that it is fundamental to change the way equal opportunities are promoted in science by both sensitising decision makers and making women becoming aware of the stereotypes affecting their career while also empowering female scientists. The approach is fundamentally a 'become aware and fight for your rights' method that promotes cohesion amongst female researchers. Cohesion is achieved by helping them to identify key success factors that will help to generate a higher and more effective consciousness on the importance of acquiring gender equality within the workplace.

Women, too, often believe that applying themselves and doing well is sufficient cause for success. This is unfortunately untrue and women accept the game set by the dominant groups in order to comply with the principle rules. Also, superb women scientists may not pursue academic careers simply because they are not encouraged to do so and are discouraged from seeing themselves as potential scientific leaders. Formal encouragement to pursue their inclination is needed.

Institutional transformation calls for collective analysis of attitudes and the behaviours they spawn, which can be disturbing, because it requires commitment to issues like lifestyle, family responsibilities, societal norms, and scientific customs. Essential to the process is the individual ownership of the blueprint for change. Strategies exist, but systemic change can only occur if propelled by the vigilance of tenacious women, and men, at all

levels, with the support of prominent leaders of our universities and research centres and by national and local policymakers. Therefore it is important to set up channels for systemic dialogue among science and technology researchers, specialists in gender studies, policy and decision-makers as well as relevant social organisations. These groups need to plan actions, evaluate their execution and promote the participation of representative civil society institutions related to science, technology, engineering and innovation in policy discussion.

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5.0 A Closer Look at Estonia from Inside

Imbi Tehver

Data for the gendered European map in relation to physics research and education show that more eastern and southern European countries' female students find the discipline of physics an attractive option than in the northern countries. The data for Estonia belongs to the northern countries. Indeed the proportion of female Estonian speaking students is very small. A possible reason may be that Estonia has adopted a widespread attitude to physics as an engineering science.

During the period from the 1950s–1995, the proportion of female students attending the Russian Department of Physics of Tartu University was around 50 per cent. A possible explanation is that there were only a few faculties (medicine, physics, mathematics, and Russian and Slavic languages) at Tartu University for Russian-speaking students.

I would like to point to some general but important Estonian-specific features. First, in the 1990s, the restoring of Estonian independence caused widespread socio-economic and political changes that affected scientific research to a great extent and as a result the leavers-stayers axis. These factors were specific to Estonia in comparison with other partners in the UPGEM project. Second, the socio-economic and demographic smallness of Estonia restricts the internal mobility (opportunities) of scientists and researchers. Estonia has neither an extensive network of research centres and universities nor large scientific projects with numerous collectives of scientists. There are only a few institutes (the Institute of Physics at Tartu University, the Tartu Observatory, the National Institute of Chemical Physics and Biophysics in Tallinn) where an aggregate of a hundred of scientists carry out serious research work in physics. Such a small scale causes special features on the leavers-stayers axis. But interestingly, despite the smallness and the general shock of the 1990s, features within the

context of the UPGEM project that are common with other countries do occur; the gender axis being a prime example.

In a focused context, the scientific research environment experienced an abrupt transfer from one state to another in the 1990s. During the Soviet regime scientific research was mainly governed by the Academy of Sciences. The system was created in Estonia after the Second World War with the Estonian Academy of Sciences being affiliated to the Academy of Sciences of the Soviet Union and funded from Moscow. During the forty post-war years more than ten new research institutes were created, four of which dealt with physics, including astro, bio and geophysics. The accent at the universities (Tartu University and Tallinn University of Technology) was on teaching first and research work second. The leading research centre of physics was the Institute of Physics of the Estonian Academy of Sciences with about 400 scientists. After the Soviet Union collapsed, the academic scientific institutes lost their funding from Moscow. In the independent Estonian Republic, the whole academic system was reorganized. The Academy became an assembly of academicians and most of the scientific institutes were connected to universities; a few, however, retained their independent status. As a result of the re-structuring and reducing the financing, the number of people engaged in research decreased dramatically. In the Institute of Physics, now part of the University of Tartu, the number of scientific researchers dropped to 80, but now the number is slowly increasing again. So, there were additional factors in Estonia that affect the leavers-stayers axis. Some were affected by key 'push factors', like small salaries (which were significantly lower than in the business sector) and redundancy. Others were affected by key 'pull factors' such as new job opportunities, better pay and better career options. These pull factors clearly had, and still have, a bigger effect on male physicists. In the context of push factors like low salaries, there was the same tendency - female leavers were less affected. Interestingly, in Latvia where science financing was lower than in Estonia, the percentage of female physicists almost doubled.

What are the main factors which affect women to either leave or stay in physics? Usually familial issues are mentioned. I would like to refer to some other factors. The UPGEM study has discovered, as a characteristic common to all the partner countries that a female physicist's career largely

depends on her supervisor. Also important is the team a female physicist works in and her self-evaluation of her role in that team. Women, on entering male domains, which is still true of physics, often feel uncertain and they tend to underrate themselves. They have difficulty in finding a suitable identity because the main stereotypes of physicists are characteristically male.

I would like to add one more to the list of stereotypes of physicists. There is a stereotypical physicist-sportsman image. His work is very much stimulated by the competition among both individual physicists and research groups. There is, I feel, an apt analogy between physics and sports. Physical success is dependent on a daily training program; but if you do not have sufficient self-motivation to play your chosen sport, training will not help and your ceiling of achievement will always be low. This attitude is as valid for physics as in sports.

Drawing parallels with sports is potentially fraught in the context of gender as men and women naturally have different abilities and both have their own scales. I do not suggest that there should be male physics and female physics. I want to draw your attention to the circumstance that nowadays science is a creation of collectives, where male and female researchers can have complementary roles to complete each other.

Physics in general is moving towards an interdisciplinary area. In Estonia where the physics 'environment' is starting to stabilize, the shift towards materials science (a mixture of chemistry and physics) and environmental research has taken place. These are disciplines which seem to suit female researchers. Some common features with the other countries of the UPGEM project (especially with Finland) can be noticed. Changes in academic and scientific work, such as competing for research funding, international evaluation and pressures to publish more frequently, as well as an increasing number of graduate and postgraduate students are common features as is the use of information technology and internet-based communication by both genders.

6.0 Similarities and Differences in Female Physicists' Professional Lives – UPGEM conference speech

Pia Thörngren Engblom

I am Docent or Associate Professor of Nuclear Physics, which is equivalent to the German rank of *habilitation*. I still do not have a permanent position, so I am one of those people who "freelance" in academia.

I would like to start by thanking Cathrine Hasse and the organizers for inviting me to be a part of this event. On a personal level, it is very exciting, and it feels like a logical step for me after participating in the first International Conference on Women in Physics in Paris 2002, which was the starting point for my active engagement in these issues. Since then, I have been developing and working with networks for women in physics and am currently also pursuing a research project on gender in physics.

The Paris Conference functions well as a starting point for our discussion today, because we had a session there called "Regional Differences", which is one of the more important topics in the UPGEM publication *Draw the Line!* This particular Paris session gathered more than 80 physicists from more than 40 countries. We had three discussion groups that all searched for similarities and differences in our respective professional lives, and it was striking how many the similarities were; whether the origin of the story was Japanese or Nigerian, we could constantly see our own lives in the stories of other physicists. Furthermore, we found and discussed the asymmetry between the percentages of female physicists in southern and eastern Europe compared to northern and western Europe; this asymmetry is also thoroughly investigated by the UPGEM project.

We were charged by Judy Franz, Secretary General of IUPAP, with explaining why Sweden has such a staggeringly low number of female physicists compared to the number of male ones. Why is this the case, when Sweden is supposed to be such a paragon of gender equality? We

could not find a complete explanation for this problem, but we had some ideas. This issue served as a starting point for the Swedish delegation, and we then tried to find common patterns for all our regions, for what made it easier or more difficult for women to work as physicists. These common patterns overlapped, more or less, with the conclusions of the UPGEM project that are presented in *Draw the Line!* For instance, the first thing that all the conference participants mentioned as a positive influence is a strong state: a social welfare system, well-functioning child care, etc. On the other hand, participants from developing countries stressed taking care of the elderly as a time-consuming part of women's lives. In northern Europe, or even in Europe as a whole, we do not think about this, while in many other countries, women are principally responsible for taking care of both the children and the elderly. If we want to think globally we have to take this into account.

The importance of supportive families, particularly husbands and mothers were brought up as a crucial positive factor. 'Mothers' were mentioned more frequently than 'fathers'. I do not know if this reflects reality. Also, the flexible working hours of a research position was one near-universal positive, with the exception of Japan, where researchers are expected to stay very late at work, even until midnight. This clearly makes it more difficult for women to meet the demands of both the workplace and the home. Unlike the UPGEM project, however, our session did not spend a lot of time discussing the workplace climate, but this was probably mainly due to the fact that there was a specific session designated for this topic. In any case, many sources tell us that the general working climate at universities is detrimental for developing gender equality in physics departments.

When discussing the negative influences, we came up with a much longer list. Age discrimination was agreed upon as a major deterrent for women, who often start their research careers later. Moreover, they have a different career-pattern compared to male researchers, but since the latter are considered the norm, women often lose in comparison.

Non-transparent hiring processes, which are also demonstrated by the UPGEM report, were also stressed as a negative factor for female researchers. The positive case of Turkey supports this trend, as Turkey manages to keep the same percentage of female physicists at the Ph.D.

level as at the faculty level. A Turkish physicist at the conference said that they have a very clear and transparent promoting scheme: when you do this, then you get promoted and so on. However, since the session was six years ago, I cannot say for sure that this is still the case today.

Another negative factor discussed was the consistently recurring issue of late tenure appointments. This often affects women more than men, as they seem to shoulder more of the responsibility for taking care of the family. In Sweden we have a paradox: the social support system is very good but its effect on these kinds of careers is negative, because all the women are expected to stay home for one and a half years with their children, since the system allows for it. Partly as a consequence of this, Sweden is one of the most gender-segregated working areas in Europe and the division of labour is very clear. In my opinion, the Swedish system locks women into expected life patterns. In a similar vein, female physicists from eastern Europe and Estonia and Latvia say they have fewer opportunities for travelling today, due to a lack of funding and to age restrictions, notably present in many European Union grant specifications. A female physicist from Latvia put it this way: "Before, we could not travel because of the Iron Curtain and now we are hindered by the lack of money and because we are too old."

So how can we change this? In Sweden, more than 90 % of physics professors are male. These patterns are not changing. There was a slight increase in female professors and research assistants in the 1990s. This occurred at the same time as we had a Secretary of Education and Research who created some positions designated specifically for women. Incidentally, he was also severely disliked in the university world. Eventually, after a female researcher was given a position in Gothenburg, the European Union ruled that this was against EU regulations. Instead, a male researcher was given the position.

How can we change the situation? We can make this set of recommendations that we are putting together today at the UPGEM conference. Other conferences have done so, and I really think it is important, since it gives a roadmap of the changes that need to occur. We can discuss the problem and make it visible, but I think for anything to really happen, it is crucial for the management and leadership to alter their approach. More specifically, the management has actually to recognize what is going on. Allow me to give a

couple of personal examples of how the workplace climate can be complicated for female physicists, and of how the management needs to act. When working as a post doctoral researcher in the United States, there were several other post doctoral fellows in the same collaboration. One of my male colleagues said: “Oh, I have a request, can you make some copies?” to which I answered: “Oh, I’m sorry. The copy machine is over there.” This is just a trivial example of how female researchers are frequently treated as lower-level collaborators or almost as secretaries. Another of my post doctoral colleagues was constantly very aggressive and challenged me all the time. It is very difficult to collaborate in that kind of atmosphere, so I had to respond and tell him off. I went to the professor of our collaboration and explained the situation to him, and that I had to respond the way I did in order to resolve the situation. His reaction was exemplary and just what I needed. He supported me completely and said that if I needed any help, I should let him know. That was all he said, but it was all he needed to say. I knew that if something happened, my professor would back me up. I have never received this kind of support in Sweden, despite the supposed advancements in gender equality. This is the kind of awareness that is required, and it is required from the leadership. And since we now know all about these mechanisms, we have to educate the leadership now and that is why the recommendations we make today are crucial.

7.0 When Did We Agree We Were Playing Backgammon Today? – UPGEM conference speech

Anja C. Andersen

As Pia did not mention it herself, I would like to mention that she has had a career as a professional dancer before she took up physics. I think it shows that women can go many different ways and have several careers and still be rather young when they graduate as a physicist.

I am an Associate Professor at the Niels Bohr Institute and I got a permanent position a few years ago. I got it because was a woman - and only because I was a woman. And I do not mind that. I doubt that any of my colleagues actually remember that was how I got the job. The reason I got the job was that we had a very visionary institute director who was aware of all these reports showing that women come in as the competent number two. So he said: "If I can find the money and if I can find a competent woman as the number two, I will try to get her in." That is how I got in, and I am paying my own salary until 2010 because I was lucky enough to get a big bunch of money for that. The reason for telling this is to show that it is not a problem to get quoted in. In fact, it is very nice being on the inside showing what you can do instead of being outside kicking the door with no chance to show.

I am also the chairman of 'KIF - Kvinder i Fysik' ('Women in Physics') and have been so, on and off, for ten years. I have shared the chairmanship with Cathrine Fox Maule who is currently on maternity leave. We are about 180 members and the idea is to network, to cheer up each other, to have role models, to discuss strategies, and to have a voice in the press. And we actually have lots of press-coverage considering that we are such a small network of women. And what I do not understand is why we do not have a network of women in Danish or history or anthropology, because I think they have much bigger gender problems than we do in physics. In physics, we have 25% female master students and 25% female Ph.D. students. And,

yes, then we have less than 10% permanent of the staff who are women, which seems to have been a very stable number for 30 years, even though the pool of women is slightly increasing. By comparison, humanities have 70% women graduating and 30% women in Ph.D. studies. It makes you wonder how the 30% men graduating in humanities suddenly are so much more promising than the women that they end up with all the Ph.D. grants? That is one of the mysteries and I really do not understand why they don't do a network but I would recommend them to do so.

In 'Women in Physics', we collect statistics, among other things, because numbers is one thing physicists really do understand. If you can document something, do it. Like the MIT studies, which was touched upon yesterday, which was a very "physics way" of doing it. They took all the women professors and all the male professors and measured the square metres of the laboratories, they counted the number of laboratory technicians, they counted the number of Ph.D. students, the number of Post Docs, the number of grants, the number of papers they published, the number of citations and how much teaching-duties men and women had, and what their salary was. Had you asked all the women prior to the study if there were any gender discrimination at MIT they would have denied it. And the men would have, too. The leaders would have said "No, on the contrary, women have a bit of an easier time, because we always like having a pretty woman on a committee". But it was all wrong. It turned out that the women had smaller labs, less laboratory technicians, the worst teaching duties of the not-so-fun courses (like teaching maths to biologists who could not care less about math, instead of teaching fourth year physics to physics student who really love having physics). And MIT fixed it. I would love to see a similar study in Denmark but not just in physics, since the numbers are so small that it is statistically insignificant. Instead, a study could be done in all natural sciences - there are lots of women - and I am absolutely sure that something similar to MIT would come up.

Although I agree with Nina Smith when she says that we do not need anymore reports, I do welcome this study because it puts a finger on something which I cannot see. I am in the system, I read the UPGEM reports and I recognize lots of things. I have even tested it on my female and male colleagues, and Ph.D. students as well as Post Docs, by telling them about the UPGEM conclusions and asking them how they feel about

them. I talked to a female colleague on the phone, and she was silent for so long. I had to ask if she was still there and she replied: "Yeah… yeah, yes I'm just testing if I can relate to it. Yes, it's true, that's really how it is". I think it shows that the UPGEM reports in *Draw the Line!* probably are holding on to something true. If they were wrong we would just discard them by saying: "This is absolute nonsense, we don't believe in this, and we are physicists, we don't believe in anything by default". And if we knew it already we would not take it very seriously, but the fact that we have to think about it, to feel it, to go into our stomachs and say: "Yes, wow, this is probably true" means the UPGEM project has caught something that we ourselves cannot see. We cannot see it because we are in the middle of it. Therefore, I really appreciate studies like UPGEM. I hope they will have some influence on the personnel structure at universities. I am very happy to see that we have persons from both Copenhagen University and DPU who are trying to do things for the workplace, because I do think it is important.

I found the presentation of three types of scientific cultures very interesting; the Hercules, the Caretakers, and the Worker Bees, and it made me wonder where women thrive? I think women would thrive better with the Hercules kind of environment, because the good thing about Hercules is that he is very transparent. Your colleague might be an alpha male, he might be a gender biased bully, but you know exactly where you have him. You know if he hates women or not, and if he thinks you have a chance. Personally, I think it is much easier to deal with a professor who looks me in the eyes and says: "Women just don't have what it takes, they can't think 3D. They just don't have it." Because then you know what you are up against, and that you should not expect any support from him. This way it is much easier than all the very small, subtle things which you cannot really put your finger to. People very politically correct and tend to express appreciation of women and stress that they too pick up their kids two days per week from the kindergarten. It is almost like a comedy: "I don't hit my wife, so I'm really a good guy" – but in reality it is business as usual. I think women thrive well if the system is very transparent and know what the requirements are. In that respect I think maybe women would thrive best in a Hercules culture. To us women, it is not a problem at all to live up to the requirements as long as we know what they are. But the problem is

very often like this: I have been practising chess for weeks, and I come very well prepared with my little chess set – but when I enter the meeting room I see everyone else is sitting with their little backgammon board. And I wonder: "When did we agree we were playing backgammon today?" I have no clue when it happened. I was not in the men's room or where ever it happens. And I think such things happen quite often and when it does you are out of the game.

With respect to the University of Copenhagen, for instance, I wonder where I find the advertisements formulated for the positions that are put up? Who writes them? It has been a mystery for years. I hope that it will be transparent now that we have a more strict management structure though I am not entirely sure, but time will show. It is an important part of a position whether it comes with a shoe size smaller or larger than size 43. Already in the advertisement, signals about who is really wanted are sent. I was very aware that I had a gender already in high school, because I was the only girl in the class. I was called by my first name by my physics teacher whereas all the guys were called by their last name. The grade I got in physics was sort of the 0-point of what you could live with if you were a guy. If you got a grade lower than mine you were really not doing well in your physics and maths classes. So I thrived really well coming to university realising that there were 25% women.

Today, I am pleased to see that the percentage of men at the UPGEM conference is 10%, because I am fed up with conferences like this where you have a bunch of women with all the good intentions discussing women. But the people who are in power, the people who can do something, they are not attending. If any of the men who are here today ever wondered what it is like being a woman in physics - now you know. And think about what you do at lunch; do you talk to other women or do you tend to gather in small groups with the other men?

I would like to add two more things concerning the work we have done in "Women in Physics". Among other things, Cathrine Fox Maule and I, together with two researchers in Aarhus, made a leaflet about the FREJA project, in which we evaluated FREJA. The FREJA project in Denmark was established to support *F*emale *RE*searchers in *J*oint *A*ction; money was put up only for women researchers to build up a small group. It was not a lot of money; however, it drew a lot of attention from the press. It was a

minute pool of the research money but it made such a fuss. The money was very well-spent, the competition was very tough and it got a lot of women out of the bushes realising that they actually had ideas. A lot of projects that did not get funded under FREJA, still happened because they got funding from other sources. I think that if we could do something similar to FREJA, it might have a big impact. One could say that maybe there are no problems anymore, since we have joint EU projects, like UPGEM, dealing with important issues. Though I like the EU – a lot of things on equality come from the EU at the moment – I would like to mention that I do not find the discussions in Denmark very fruitful. Denmark is often thought of as one of the best countries in the universe, and the best country is perfect, and that makes it difficult to discuss equal rights. Denmark has probably the most gender segregated labour market, and in my opinion lots of the drive in terms of gender equality actually comes from the EU with legislation. EU has a lot of good intentions of how to distribute research money and how to get women in. However, they want 40% women on the panels which one can discuss if it is good or bad; I am not necessarily sure that women are better people than other people. I think we are just as biased as men, so that is not the whole solution.

A few years ago, "Women in Physics" did a small commentary for Nature. We looked into something called the European Young Investigator Award in 2004, where almost 800 people applied and they ended up giving 25 awards. It was an interesting selection process because it only lasted over four months. It was like a three-step rocket; first there was a national selection, then a selection in the EU, and finally some were invited to an interview where they selected a few. We found that in each little step of the evaluation, the women fell out slightly, not enough to be statistically significant, but if you added up the three-step rocket it was very statistically significant. Things do happen randomly and maybe the men were smarter than the women that year. But the chance of that happening just as a random thing is 0.05 %, which makes it almost impossible to happen. Nevertheless, it still happened. And that shows that even though you have all the good intentions you still need people to be there to look at the numbers.

8.0 A Take on Possible Solutions to Gender Equality Problems in Academia – UPGEM conference speech

Jonas Dahl

It is clear to me that we face some difficult issues when we look at the general difference in science careers between men and women in Europe – and Denmark. The importance of solving these problems is obvious. First of all, gender equality has to apply to the academic world as well as everywhere else. There is no reason, at least not of the scientific kind, why men and women should not have equal opportunities to pursue a science career. Second, we live in a day and age where the importance of mobilizing all the potential in respect to research and education cannot be overlooked. Furthermore, women have no less potential than men.

Let me address some of the issues and try to point out possible ways to deal with them. The solutions I see are, perhaps not surprisingly, quite close to the recommendations of the UPGEM partners. I found the parts of *Draw the Line!* which I have had a chance to read very informative. The UPGEM project makes it quite obvious that men in general do not experience the same cultural obstacles for pursuing a career in science as women do. It amazed me that women account for 95% of parental leave in Denmark. Of course, everything else being equal, being away from University for a long period of time holds back career development compared to people who are allowed to continuously put all their effort into scientific work.

How do we create a more equal 'distribution' of parental leave between men and women? The Socialistisk Folkeparti has proposed that three months of the paid leave per child should be required to be used by the father. We think this kind of legislation would be a crucial step towards changing the way families divide parental leave between the parents.

Unfortunately, the proposal has until now been rejected by a small majority in the Danish parliament, but we will continue to promote it.

Of course, the university as a workplace can provide assistance to researchers with children in different ways. Just yesterday my old university, Aarhus University, announced that it would start using new means to strengthen the career opportunities of female researchers with children. An 'in house' kindergarten, for example, and care facilities when a child is sick are two of the initiatives that will be part of an upcoming plan. Socialistisk Folkeparti views this as a necessary development in respect to gender equality in the academic world. And we will study the concrete initiatives in the plan with interest.

The fact that many female scientists in Denmark have experienced some sort of sexual harassment, as mentioned in *Draw the Line!*, shocked me. This is simply not acceptable. It is of absolute importance that leaders of research institutions are tightly focused on the well-being of their working scientists. If the workplace culture is to be improved with respect to the relation between the sexes, then the abilities of the leadership at the institution to handle this dimension must be strengthened. The universities probably need to be more aware of this in the contexts of employment contracts and the continuing training of institute managers. We need courses for managers and research leaders that give them the social tools necessary to prevent and solve gender relations issues such as sexual harassment. At the same time, we need to ensure that the local institute leadership can draw on a centralised 'Human Resources' staff that has special competences in these regards. The political system can support this by establishing a special fund for the universities that covers the expenses associated with implementing such a policy. This would be a fund with the clear purpose of enhancing the workplace culture at the universities where women can thrive much more easily.

When it comes to special funding, I also have to mention the FREJA programme (Female Researchers in Joint Action) which between 1998 and 2001 gave a significant amount of funding to research projects initiated and lead by women. The programme resulted in quite a few female researchers getting permanent positions in the academic world, and was in that way a success. Therefore Socialistisk Folkeparti would like to revive it, and we

plan to put forth a proposal to this purpose in the Danish Parliament in the fall 2008.

The UPGEM-publication *Draw the Line!* mentions the mode of competition as a deciding factor in women's relation to a given science group. It talks about two different types of competition – negative and positive. I think competition and cooperation are and should be very much central in the practice of science. Professional and thorough critique produces the best results. We must acknowledge the force of competition as a central social mechanism that enhances the quality of scientific results. It is, however, crucial that the competition unfolds *within clearly defined social rules*. Competition and critique must never have a destructive impact on the motivation of any scientist – male or female.

9.0 Knowledge, Institutions and Gender: An East-West Comparative Study "KNOWING" – UPGEM Conference Speech

Anne Kovalainen

First of all, let me offer my congratulations to the UPGEM project. You have done a great and thorough work and the conference is superb, as we all have recognised. I think that the book *Draw the Line!*, which very nicely summarises the results of your work, really attracts a lot of questions because it is so thorough. The book describes well the very core that you talk about, namely the workplace related issues: how work is in academia in the five UPGEM countries.

UPGEM's results are indeed very interesting as well as new and I really appreciate them. My interest come from what I would call a "sister-project" to UPGEM; the KNOWING project. Like UPGEM, KNOWING is also one of the Framework 6 funded projects on women and science. In the following, I will shortly present some of the KNOWING projects' key points in order to relate them to the UPGEM research results. Finally, I will touch upon some of the issues that came up at the conference yesterday in discussions concerning universities as workplaces and the changes that academia are facing.

9.1 The KNOWING project

The KNOWING project is still on-going. It comprises five national research teams: Austria, The Czech Republic, Finland, Slovakia and UK. Our coordinator, Marcela Linkova, is from The Czech Republic. The key idea of our project is not so much focussing on specific work cultures and workplaces, but more on the formation and development of epistemic

communities. Then again, epistemic communities could be understood as workplaces and work cultures. But they are also something else. We are looking at the practices of cultures in natural science and in social sciences. We compare social sciences and natural sciences; humanities and hard sciences. The basic outcome when we were outlining the project was building on feminist epistemology and science studies within social sciences.

9.2 KNOWING objectives

We are especially interested in looking at what happens when scientists are doing their work in social sciences and in natural sciences: How do they do their work? How do they form links, how do they communicate with each other, how do they collaborate, how do they form alliances? Obviously, all of these mechanisms or ways of working are gendered by nature; we see that very clearly in earlier research. But they are not only gendered, they are very much embodied, or in other words they are embedded in corporate reality. Here, at the UPGEM conference, we have heard of research results in relation to how it is to be a woman, or a man, working with certain restrictions, with competition. All of this has an impact on the ways you create science, the way you create new knowledge. That is one of our objectives.

Moreover, we are interested in looking at the geopolitical occasion, how that formulates the differences within European sciences. If the starting point is a more competitive Europe with respect to research, we need to tackle the issue of geopolitical differences including how these borders and boundaries are being created and how they influence the formation of epistemic communities and cultures within these two science fields. So, in a sense our targets are also very strongly related to science formation. At this conference we have also heard about the former communist countries and it is a question of how feminist science studies become part of the academic curriculum in those countries. Additionally, the structural and institutional obstacles and hindrances for women to participate are important. How do women become full members within their fields? Concerning the EU-level, gender equality contribution to the public debate is very much on the agenda.

9.3 Methodology

It is really nice to hear how well structured UPGEM has been, and how profoundly UPGEM has carried out the work. I must admit that we have not been so thorough, but our methodology has been slightly different. Even though we have gathered huge amounts of data, we have analysed it on a national basis, in the national languages. This was partly because of the differences in approaches, but also because we wanted to keep the nationalities present in the methodology. Different solutions lose and win in different positions. We have gathered lots of science policy data which we have gone through by very thorough documentary analyses. We have used participant's observations, in-depth interviews, focus groups and shadowing observations which have been quite important for our research. I mention this to show and understand how the researchers work; how they become gendered members within their disciplinary field. Currently, we are in the process of analysing the data material therefore it is not possible for me to tell about our results yet. The data material has been gathered in all five countries in different institutions and departments. Obviously, access to the institutions has not always been easy, but luckily we have always gained access both in natural sciences and social sciences. We have a huge variation between departments and number of people working in different groups which makes the data very varied. Different forms and different ways of forming research groups are interesting and that has been a learning experience for us as well.

9.4 Project impact

All of the EU-projects have their impact and I assume that it will not remain on a policy recommendation level only. After having read the UPGEM publication *Draw the Line!* and listened to the presentations and debates here at the conference, I very strongly believe that there will be a strong impact, not just in terms of policy recommendations but also practical solutions at the national levels. The contribution of the KNOWING project is a comparison between natural sciences and social

sciences: Are there similarities and differences in relation to career paths? We are now deeply embedded in the analysis, the national level reports are about to be finished and for the rest of 2008 we will be working on international comparisons on selected topics. Hence, I cannot say much about the international results yet. Instead I will say just a few words about the Finnish results and relate them to the results of the UPGEM project. I would like to point to two very interesting findings. First, there is a totally different logic in natural sciences than in social sciences in terms of relating to the research communities and relating to the university. It seems that within natural sciences people are more attached to their lab-groups or research groups. That is the first formation of your researcher identity. For many of the respondents the research group is important, not the university. They did not seem to care very much about the research politics within university. For instance, some hardly know their Rectors' name, to exaggerate a little bit. With respect to social sciences, university was an important place and they were more embedded into the university. That creates a profound difference in how we understand the way of formation of science and knowledge. The second point I want to take up here is related to the differences in the outcome concerning mobility. Mobility for natural scientists was something that is embedded in the unity of science. Everybody writes in English because international and national publications are the same. Everybody targets the same journals, irrespective of the country. While for social scientists it is more important to understand your own society. Most of the research questions are partly related to your own society. Therefore, being influential in your own country is important for social scientists. International mobility has a very different dimension for social scientists.

In relation to the discussions yesterday on the importance of management, I would like the UPGEM project to think about whether the idea of management of universities should be extended to research project management as well, because many of the lab groups and research groups are formed at stages of your career where in many ways you are not yet experienced. First, you have frantically worked with your Ph.D. and then you become successful in getting a big research grant. But you have no abilities in managing people. That was a surprise for many of the researchers. So many of these work related hindrances and different ways

of talking about things could be avoided if those who move on to a post doctoral position, which is when you start forming your own lab groups or research groups, would get some kind of management or leadership skills. This was an idea that came up in our discussions yesterday.

9.5 Conclusion

I will end with two things. The first one comes from the Finnish material I was working on together with my colleague. We were analyzing the focus groups' material and we found three different layers of epistemic communities in the Finnish material. First of all, and this relates to the UPGEM project results: The workplace level, the every day research community which is the first layer in epistemic community formation, is the department – it is the physical environment, it is the university or research group. But these people do not necessarily have much in common. Not in social sciences, not in natural sciences, because they work with different ideas, with different materials maybe, different kinds of questions. This is even more so in the social sciences. So the question is how much does the workplace matter? How does it relate to knowledge production? Let us take a look at the national research community, the second layer of epistemic community that has high or low relevance depending on the science field. In natural sciences it might not have any relevance at all. You know that there is a lab in another city in your country, but they work with different things. Whereas in social sciences you know that they do research that is related to, or not related to, your research. For social sciences, national research communities might have more meaning. The third layer of epistemic communities is international research communities that seem to be present virtually all the time; when you start your Ph.D. and when you work as a professor. Different varieties of forms are just international collaboration: publications, conferences, peer reviews. Everything works at the international research community level. So the clash between workplace level and international community level can be huge. This is something that might be fruitful for UPGEM to think about.

The second thing is that after having read *Draw the Line!* and listened to the discussions yesterday, I think that we have identified a system level

problem. Due to the university changes in all the European countries, the intensification of research activities and the massification of those activities, the whole career track idea have led to problems both in funding and pipeline problems. We were discussing this yesterday. Somehow, it seems that the grassroots reality level and the science policy level do not meet. We have heard many descriptions of the every day life problems concerning how to take care of children, and what kind of possibilities you have for your career when making it as a gendered person. The problems in the real lives at the individual level are manifest, in the KNOWING as well as in the UPGEM data material. Our discussions on work stability and permanent positions showed that instability in this respect can lead to motivational problems or motivational questions and, of course, family - work life related aspects. But the science policy level problems mostly manifest as competitive advantage questions. There are no human beings in that discourse. Therefore, I welcome very strongly UPGEM's ideas presented in the workplace discussions. It should be taken up in the science policy level discussions, so that it would no longer be individual problems of men and women who do not fit into a specific workplace culture. This, I believe, is a science policy level problem.

10.0 Research or Children? The Grand Dilemma of Female Researchers

Lisbeth Dons

10.1 Introduction to WOMEN-CORE

The WOMEN-CORE project (Women in Construction scientific Research) was launched in 2006 with the aim of strengthening women scientists' participation in construction research in Europe[1].

WOMEN-CORE focuses on the construction sector for two reasons. First, the construction sector is one of the most important industry sectors in Europe in terms of economic growth and employment. More than 26 million workers in the EU can be said to depend on the construction sector[2]. Among these, the construction researchers of course constitute a minimal, but an influential part in terms of enhancing the competitiveness of the European construction sector. Secondly, the construction sector is one of the most male-dominated research sectors in industrial research, and furthermore is under-investigated. While women's participation in the overall construction industry has been documented in statistical figures and in the works of social scientists (European Commission, 2006; Kvande & Rasmussen, 1987), very little is known about women's role in construction research, especially in industrial settings.

WOMEN-CORE's overall objective is to strengthen women scientists' participation in European construction research. This is achieved by means

[1] WOMEN-CORE is co-financed by the European Commission under the 6th Framework Programme. WOMEN-CORE is implemented by a consortium of 6 partners in five countries: LABEIN (project coordinator) and CIREM, Spain; GESIS, Germany; CVUT, Czech Republic; Loughborough University, UK, and Copenhagen Institute for Futures Studies (CIFS), Denmark. Project duration: April 2006 – December 2008.

More information about the projects is available at: www.women-core.org

[2] Tupamäki, O. (1998). *Construction Can!* ENCORDs Programme for RTD&ID, European Network of Construction Companies for Research and Development. Helsinki.

of enhancing the women's knowledge and influence in this particular research sector; assessing their gender-specific needs and providing new measures for empowerment for them.

The WOMEN-CORE project has examined different aspects of public and industrial construction research. Analyses of already existing data as well as quantitative and qualitative empirical studies complement each other to form a comprehensive base of information about the population of researchers, scientists and engineers, the industrial and academic work-places of construction researchers and special studies of particular parts of the research career, such as publications, peer reviews and patents.

A specific objective of the WOMEN-CORE project is to explore new opportunities and provide recommendations for empowering women in construction research. Therefore WOMEN-CORE assessed the prevalence of relevant mentor programmes and professional networks in Europe, and is currently taking measures to create a European network of construction researchers.

This paper concerns a qualitative study, which compared career paths of patent holding researchers in construction with colleagues in pharmaceutical science and chemistry. The study involved semi-structured interviews with patent holding researchers in the construction sector (13 women and 13 men) and chemistry and pharmaceutical science (19 women and 8 men). The interviewees were recruited from both industrial and public research sectors. Interviews were conducted in The Czech Republic, Denmark, Germany, Spain and the UK. The interviewees were asked about their choice of education, the transition from studying to work, their ambitions for their career and for their personal life, their workplace and work/life balance, and their reflections on themselves as researchers and on issues of gender equality in research.

We wanted to assess all aspects that might impact on the patent holding researchers' careers. Thus, we examined researchers' career paths right from the graduate's choice of a research career until the time of the interview, as well as their wishes and plans for the future. As such, WOMEN-CORE's design of this research task is in many aspects similar to that of UPGEM, and so are the results. The challenges that women natural science researchers face in their careers today appear to be very similar, irrespective of research field. As the summary of the findings and

conclusions of WOMEN-CORE is too extensive, my contribution focuses on one dominant issue that repeatedly appeared in the WOMEN-CORE interview data: the dilemma of research career and family life reconciliation.

10.2 Reconciliation of research career and family life

The majority of the interviewees denied that gender discrimination took place in regard to recruitment and promotion and daily work. Instead, they emphasized that gender does not count, only "competencies"/ "performance"/"work capacities"/"qualifications" do (Spanish female pharmaceutical researcher, aged 45–54 (ES_12), German male construction researcher, aged 45–54 (DE_11), German male chemist, aged 55–64 (DE_06), British female chemist, aged 35–44 (UK_08), and Danish male construction researcher, aged 35–44 (DK_12)). We were surprised how often both women and men expressed these statements, which seem to indicate that gender differences are perceived as personal differences. Still, both women and men observed that women researchers to a larger extent than male researchers were taking care of children, and that such family responsibilities were a major obstacle to the research career. In fact, one of the most important decisions of a research is whether to have children or not. When parenthood is considered an entirely individual choice, the challenge of work and family life reconciliation within the research community is not recognized as a hindrance to the professional performance of the individual researcher.

Parallel to the findings of the UPGEM project (Hasse, Sinding & Trentemøller, 2008), WOMEN-CORE's interview data revealed various examples of problems with work and family life reconciliation, and in most cases these problems affected women more than men. This is not news to the experts of gender equality, and the examples are abundant. It seems that women are caught between two 'chairs' as they try to simultaneously fulfil a wish for an interesting career and a wish for raising a family. But why does this challenge predominantly strike women and why does it in so many cases present itself as an decision of either career or family?

10.3 Devouring profession

Researchers find their profession extremely demanding for both women and men. The interviewees in our study report surprisingly long working hours. Most of the researchers usually work 50–60 hours per week. In particularly busy periods, however, some of them work up to 80–100 hours per week! Several of the construction researchers of both sexes state that they would like to decrease their workload, but they feel pressed by the quantity of work tasks: "I am not satisfied with my work/life-balance, but I am not sure how it can be improved. It lies in the nature of my work, I cannot do it with only 25 hours per week" (German female construction researcher, aged 45–54 (DE_03)). The interview data clearly shows that working part-time is not at all common in research, and researchers who work full-time (i.e. in most cases with considerable overtime, as previously mentioned) express that working part-time does not fit with their work functions. Three women (and no men) worked part-time. All had chosen part-time work in order to take care of children and considered this situation temporary. While two of the women considered part-time work a special privilege, they expressed deep concerns about how this would affect their future career (UK_02) and the relationship with their colleagues (ES_10), while acknowledging that part-time work was still demanding in terms of time management (UK_08). However, their wish to work part-time had been met only positively by colleagues and managers. Peer pressure is an influential deterrent. One interviewee simply responds: *" […] when everybody is working this many hours, if you don't, you are not doing enough"* (British female chemist, working 50–60 hrs/week (UK_11)).

Travel activities are also a time demanding, but very important part of the research career, according to the interview data. Most interviewees stress traveling activities as important for the career, in terms of building networks and participation in projects. However, gender differences are evident: Both women and men without children travel, while among researchers with children hardly any women travel as part of their job. The interview data clearly presented the academic research sector as a very competitive environment, where employees must constantly perform, in order to not lose temporary positions or candidacies for permanent

positions. Many academic researchers seem hard pressed, as they try to juggle many different functions, e.g. lecturing, research, writing publications and project proposal and, not least, fundraising.

In the long term perspective, researchers are also concerned about creating proper, linear CVs to help them progress their careers. This does not allow for career breaks, such as maternity.

Obviously, a position with that many functions does not leave much time to practice other aspects of life. One woman indicated that as she did not have a family to see to, she did not mind long working hours: If her husband was living in Brussels with her, she could not work so much or so late in the evenings, because then she would want to have a family life. But since she is alone in the week and sometimes at the weekends, it is okay to work overtime. (Summary of interview with German female construction researcher, aged 45–54 (DE_03)).

While most women researchers value children and family life and speak much of this in interviews, men do not mention their family status as much as women and they do not complain as much about work/life balance problems as women. As a result we may conclude that women's wishes for 'double-stranded' careers (career and family life) do not match as well with the requirements of a research career as men's 'single-stranded' ambitions for a research career.

10.4 Ambitious men, assimilating women?

Women prioritize home and children to work some men say, while a number of women observe that women have too little confidence in themselves or sacrifice their career to facilitate their partner's career instead: *"They perceive themselves as number two; that they should not progress as much as the husband"* (Danish female chemist, aged 35–44, (DK_04)). The 'male bread-winner: female nurturer' cultural model presented by Ajello, Belardi and Calafiore (Ajello, Belardi & Calafiore, 2008, p. 300) is more widespread than just the Catholic countries. Within WOMEN-CORE the pattern of assimilating wives is observed in Germany and The Czech Republic. Some of the women researchers with children say they reduced their travel activities, because their partner travels in his job

(German female chemist, aged 35–44 (DE_05), Spanish female construction researcher, aged 35–44 (ES_10)). German men, in particular, say that their wives gave up their careers when they had children. As the availability of childcare facilities are close to none in Germany, many German women have stalled their careers to take care of home and children. One male researcher admits that because of this, his wife has had a double burden compared to his own (German male chemist, aged 55–64 (DE_06)). Another man says his career progression would not have reached so far, had his wife not supported it by relieving him of domestic responsibility (German male construction researcher, aged 45–54 (DE_14)).

It is quite remarkable that a number of men say their wife and family would like them to work less and be more at home, but this does not seem to affect their motivation, while female researchers will say that they have an agreement with their husbands about the importance of the career of both: *"[...] my husband and I work at similar posts and know what it involves and tolerate each other"* (Czech female chemist, aged 55–64 (CZ_02)). Indeed, some men imagined a slower career progression had they been women, since then they would obviously have had to tend to childcare and home. Some women believe that they would have moved faster up the career ladder had they been men, while others said gender would not have made any difference, if they as women had not had children: *"The main difference would be related to maternity, not because of the fact of being men or women"* (Spanish female construction researcher, aged 35–44 (ES_10)). A few said they would probably not even be in research, if they were men. By this they implied that men try more opportunities and do not settle with a single job as much as women do.

Many interviewees, who were 55 years of age or older, observed that gender roles and values are changing; men in the younger generations appeared to value family life more and seemed to expect to share equally the domestic chores.

10.5 Conclusions

We begin to see new trends of democratization of the division of domestic labour; men are increasingly participating in childrearing. This trend must increase in order to secure a more even gender balance in different sectors of society. We recommend that paternity and maternity leave be shared equally between parents. From this brief description of the situation of women researchers in construction, pharmaceutical science and chemistry it is evident that they are in a tight situation at the beginning of their career, when both family life and career raise high demands on them, should they chose to opt for both things at the same time. The devouring research career is also an issue for male researchers, however. It appears from the interview data that things are changing with the new generations of the labour force ascribing more value to the family and being less devoted to work, while traditional gender patterns, including cultural models of breadwinner/ nurturer are slowly dissolving. In light of this, the concept of the researcher profession and research workplace culture needs to be rethought and restructured according to the requirements of young researchers. The possibility of 'double-stranded' career paths are urgently required, if the research sectors are to continue to attract qualified labour. In the long run, this is how competitiveness of the European research sector is maintained.

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11.0 Women in Science. Experiences from Haldor Topsoe A/S & Energy Research Council (ERC)

Jens Rostrup-Nielsen

Thank you for inviting me. It is a little bit of a challenge, because it is a subject I have not dealt with in depth, but of course we all have to face the problems of giving women equal opportunities, also in science. I will start by referring to Molière. Molière wrote a play, 'Les Femmes Savantes', at a time when satire was still appreciated. Please notice the telescope depicted on the book cover as I will come back to that. Moliére´s moral was that 'the cock talks before the hen' and that women would be wiser to stay with their families and not be confused by science. So, that was not very progressive.

Today I sit in The European Research Council where I am surrounded, among others, by two strong women. One is Christiane Nüsslein-Volhard. She is one of the very rare women Nobel-prize winners in medicine, and she has recently written an essay about her own experience; how she made her career, and you will see many of the same things as described in the play by Molière. When she got the Nobel-prize, the family criticized her for not having concentrated on having a family and so forth. But she could report in a very proud way, when she became director at the Max Plank Institute, that 25% of the women directors were Nobel-prize winners which the men could not match. Also there are 80 Max Planck Institutes. So we still face the age old problem of gender equal opportunities, although in some parts of the world, hopefully our part of the world, it is less pronounced.

I will concentrate my talk about the experience I have from being in charge of our research at Haldor Topsøe for almost 20 years. Since I am not in charge anymore I can talk more freely. I will also draw on my experience from the European Research Council (ERC) and try, though on a very thin statistical basis, to draw some conclusions.

An important part of the research work at Haldor Topsøe involves complex quantum mechanical calculations where we collaborate with Professor Nørskov's group at Technical University of Denmark (DTU). One of the first calculations was made by a woman Ph.D. student who unfortunately left science. Later we hired another woman physicist, Berit Hinnemann, to carry out similar calculations in the company. I will come back to her. To make such calculations you need to work for a very long time and you need to understand all the quantum mechanics. It is not something which is easy to learn. Furthermore, you will find very few people in the country, at least in this provincial place where we are living, who have any insight in this subject. So your network fills a very narrow niche. You may have friends in Boston and Karlsruhe etc., but the neighbour in the university office will know nothing about what you are doing except that you are always the first in the coffee room. So that is one thing. Also this subject is boring; you do not think it is at all interesting to discuss these curves in detail. In an environment like Denmark it is much more interesting to study literature, art and other disciplines, because you can talk about that, and you need not study these difficult subjects. Moreover, irrespective of what you do, you earn the same money at the end of the day, therefore there is no motivation to study complex disciplines.

At Haldor Topsøe we have at lot of strong women. Still, we are a few men. In the middle of this picture[1], smiling broadly, because she is at the centre of power, is our Legal Director. To the far right side is the Chief Operating Officer of our fuel cell company. Several women have senior positions in the company. In the Research and Development (R&D) division, of which I used to be the director, the proportion of women approached 35% of the total research employees. The proportion of employees with non-Danish backgrounds has increased steadily and is now about 12%, this figure includes lab-assistants etc. In the last ten years of my time in charge of R&D, covering the period 1996–2007, every second scientist I hired came from outside Denmark, typically from another EU country. Women comprised 36% of all employees and 30% of the scientists. However, 28% of the scientists came from abroad and close to 40% of them are women. So here we see the first sign that women from abroad are

[1] A slideshow presentation accompanied this speech (see http://www.dpu.dk/site.aspx?p=12440).

very active. You see the same pattern at Jens Nørskov's department at DTU. The uptake of women for Masters' studies has increased, but of the 75 Ph.D. students who have been through Nørskov´s group, 43 were from abroad and 14 (32.5%) of them were women.

In regard to female directors there are many difficult issues. Despite my efforts, I employed only one woman as a program director. Women say: 'No, thank you'. It is also a 24/7 job[2]. Though you are allowed to sleep during working hours, it is still a tough job. Women are quite reluctant. The one who chose the position as program director came from Germany. On the scientific side, excellent female scientists are doing excellent work. We now have Ph.D.s coming from Princeton and DTU, but we also have the first female Dr. of Technology, Nan Topsøe. Although she was not born in Denmark, this is also an indication for opportunities for women in the organisation. I think this kind of organisation, in which trans-departmental teams are created, is very different from that in a university environment where you build up in teams working across the departments. In universities each scientist has their own agenda and what happens in the next office is irrelevant, except everyone ensures they get more funding than their neighbour. Furthermore networks are not within the department as much as international and successful international networks are dictated by the very narrow niche of the subject.

Now, let us go to ERC which after a development period of two to three years has existed for approximately a year and a half[3]. ERC funds research in Europe, based on excellence, as well as funding individual scientists. ERC aims to make Europe a much better environment for scientists; to attract scientists from outside Europe, and signal to young Europeans that a career in science in Europe is a viable option. ERC has an annual budget of roughly one billion Euros,[4] which, if anything, is about to increase. ERC is governed by a scientific council of which I am a member. I am the only engineer as well as the only member from industry. ERC defines what should be done. Furthermore, the European Commission is creating an 'executive agency' which will say how it should be done within the rules etc. Finally, the European Union provides the funding for ERC's activities.

[2] 24/7 – 24 hours a day, 7 days a week.
[3] ERC recieved official European Parliament approval on 18 December 2006.
[4] The European Parliament approved a 7-year, 7.5 billion euro scheme.

The 22 member scientific council currently consists of 18 men and 4 women. We have four very strong women: Professor Christiane Nüsslein-Volhard (Germany), who won a Nobel prize, Professor Leena Peltonen-Palotie (Finland) who are both in medicine, Professor Dr. Helga Nowotny (Austria) in social science, who is also vice chair of ERC and finally Professor Maria Teresa Lago (Portugal) an astrophysicist from Portugal for the hard sciences. In the aforementioned executive agency there is a 'control board' chaired by Cesarsky, a female astrophysicist, who was the head of the European observatory in Chile. We are happy to have her on board because she is not easy to manipulate. So somehow the telescope, or astrophysics, has attracted women. In Denmark, for example, we have Anja Andersen who is also a strong asset. Maybe it is because astrophysics is a subject which has a more general interest; you can more easily talk astrophysics, when sitting in a café in Copenhagen, compared to many other research fields.

We have another principle that, in contrast to most other research organisations, ERC is not a social institution; we should not support research just to keep people 'alive'. We have two funding schemes. The first starts from the bottom tier of the research field in that we support young scientists who would like to begin a research career. Funds are provided to the value of about two million Euros over a period of five years which is a lot of money for a young scientist. The funds are given to the scientists, not their institutions, so if they do not like 'the smoke in the kitchen', they can take the money and move to another university. The funds are intended to build up a new research team or maybe even the very first research team. The second 'advanced grants' scheme provides funds, at a higher value, to more experienced scientists. But I need to stress that ERC is a super-league and has no intention to either distribute the money equally to different countries, or seek for a gender balance. Accordingly, if all the funds are going to Dutch men - that's it. However, we have made a big effort to make sure that maternity leave etc. will not lessen the chances for women to apply for grants. In this respect the, Swedish member of ERC's council has been very, very active on this issue. The evaluation of funding proposals is made by discipline based panels. We have twenty panels and though we do have women on them the proportion of women is very low in the 'hard' physics. However, we have more women on the

panels concerning astro-science, or astrophysics, and geo-science including environmental issues. It is easier to find qualified women in these fields. Among the panel chairs are two Danish women. Moreover, we have also made sure that we have some gender balance regarding the peer reviewers. The current proportion of female peer-reviewers is 21%, which could be better. The response to the first ERC call for proposals resulted in 9167 applications. The panels reduced this figure at the first stage to 559; twice as many as funding allowed. Finally, 297 applicants received the grant.

The gender balance of the applications deserves closer analysis. The average percentage of female applicants at the first stage was 30%. The proportions in physics and engineering were comparatively smaller and below the 30% average. After the first round, however, the total number of female applicants left was reduced to 24% and in 'hard' physics the percentage to just 8%. The number of female applicants in the fields of astro-physics and environmental education were still reasonably high. The pattern is the same for the successful applicants awarded funding; there are more women in life sciences and the humanities than in physics and engineering sciences. The numbers of women in chemistry and environmental geo-sciences are reasonably good but not something to be too proud of. In summary, the overall average percentage of women involved in the initial 9167 applications at 30% was reduced to 26% of the successful applicants. The corresponding figures for physics and engineering were much lower, dropping to 17.5% after the first stage but increasing to 21% of the successful applicants. These figures for physics and engineering could be better, but the 5% difference between physics and engineering and the total is not that drastic.

The gender balance is perhaps more interesting in the context of the 'advanced grants' scheme for well-established scientists. The average age of the applicants for the advanced grants is 50–55 years. After the recent deadline for the applications for the advanced grants, ERC received approximately 2000 applications of which 14% are women. The figures for physics and engineering are down at 8.5 %. One might say this is good because there is a discernible difference in the gender proportion between the older and the younger generations. You could, by contrast, argue that the present gender balance for current working scientists of today is not something to be to proud of.

The average proportion of women applicants by nationality (country of origin) is 14%. The highest percentages of women, all above the 14% average, occur in Turkey, Italy, Poland, and Finland. France and Norway are average. Germany and the North-Western part of Europe are all below average. Sweden, below Germany and North-Western Europe, is the big surprise. A lot has been done for equal rights in Sweden. Nevertheless, but amongst the 66 Swedish applicants only 2 are women. I think they have something to discuss in Sweden. In Denmark, we should wonder why we have only 23 applicants – of which just 3 are women. In comparison, Finland has 70 applicants out of which 20% are women. These applicants, now in their early fifties, went to primary school in the early 1960s. So it would be interesting for those who have some interest in these differences to compare the primary school systems of Finland with Sweden and Denmark in the 1960s. One difference is that in Finland, primary school physics teachers have a university education; but I'll leave that to those who would do research on it. Instead I will refer to a recent report issued by the European Union by a work group (though not with Danes in it). The study concerned the question 'What are the chances that women will make a career in public research?' The results are very much in line with the data I discussed for ERC's 'advanced grants'. The average is 15.3% to make a career and 15% for the full professorships in Europe. Denmark is, however, far below these averages whereas Finland again stands out. The very high percentages, however, are found in countries like Turkey (again), Poland, and to some extent Spain, France, and Italy. So the Nordic countries are not doing that well. Yet, we are doing very well in one respect: our women succeed in getting onto our research councils. The percentage of women in research councils is highest in our three Nordic brother countries. Denmark is fourth followed by Bulgaria and the United Kingdom. That is worth thinking about; that we have been good at gaining female representation on the research councils where they decide how to distribute the funds. Nevertheless, this representation has no bearing on who is then successful in doing the research.

Finally, let me come to a couple of inconclusive suggestions though I may be on thin ice here. Firstly, very high representations of women in the gender balance occur where things are really happening to women, such as in southern Europe, Turkey, and some of the East European countries.

Beyond the borders of Europe there is even more activity. My hypothesis would be that physics and engineering are difficult subjects to study and they are also to some extent extremely boring and you have to learn a lot. You can easily, within a narrow niche, be very isolated. On the other hand these are fields where the sole evaluation marker is professional competence. You can actually make a career in these fields. So if you are in a country or in a culture where you want to change your social status, this is one possible way of doing it. Whereas if you live in a more 'provincial' place where there is no incentive to change your social status, then why should you go into these fields? This is not a conclusion, but a suggestion which I think would be worth studying in detail.

Secondly, in the context of the choice of an academic career or not, I would like to refer to my colleague, the German physicist Berit Hinnemann whom the Danish newspaper *Politiken* interviewed a couple of months ago. She explained her reason behind her decision to leave Princeton for Haldor Topsøe was the wish to use the narrow niche of her theory to solve problems of the real world. Also, she had noticed that working in an industrial research environment she would meet people around her who were interested in what she was doing, many of whom would be from other fields. Working in a cross-disciplinary team where sometimes you support people and other times they support you is another way of working than the mono-type work done at university. That was Hinnemann's motivation. The working conditions at universities as depicted in the UPGEM publication *Draw the Line!* may very well be true at universities, but in industry we do not see that picture at all. In an industrial research environment we usually say that you have to join as a jazz band member. You have to be an expert on your instrument, but if you cannot support the people in the band playing other instruments, then you had better go to another profession.

12.0 Social Changes and Changes in Science Management: the Estonian Case

Endla Lõhkivi

12.1 UPGEM findings and discussions

In this presentation I have chosen to discuss some of the most painful issues that have appeared in Estonian science management since the independence of the country was restored in 1991. These are issues that the physicists or former physicists[1] interviewed for the UPGEM project during the years 2006 and 2007 perceived as the most relevant.

I. Changing from a key element of Soviet 'superpower' academia to a small peripheral country's research

The role of general social changes for physicists' career perspectives was recognised in every UPGEM project country. Social and political changes occurred in Estonia simultaneous to the radical change in western European science towards the commercialisation of research and the respective science policy change from Mode 1 model to Mode 2. Universities and other public academic institutions have since then been seen as part of the triple helix of public, private and academic spheres.

The fact that the two processes have been running at the same time, has had a double effect on Estonian research institutions and universities. Often the reason for the unpleasant changes in physics as a work environment is hard to diagnose, as it is either the change in the economic situation of the small country, or the global change in science policy.

Since the early 1990s approximately 70–80% of Ph.D. researchers, or doctoral students very close to obtaining the degree, have left physics

[1] Half of the 36 interviewees had left research positions for other careers.

research or academia for one reason or another.[2] Today, many physics institutes face a shortage of both researchers and teaching staff. One of the main problems is the missing generation – researchers in their 40s and 50s the majority of whom have left academia. The older generation is about to retire or continues in part-time work after retirement while young talented generation is not motivated as the pay is low and a research career has low prestige in comparison to a career in the private sector. The situation with material resources, equipment etc. is also uneven. Some institutes have made remarkable progress due to participation in large international projects, whereas others are still using the resources and equipment from the Soviet era, now mostly out of date.

Universities and the government complain the lowest number of student candidates occurs in natural sciences and engineering. Most of the interviewees perceive international communication and co-operation opportunities as improvements. The scientists blame the 'humanities' perspective governments for the deterioration in the scientific research environment and the decrease in funding. The university backgrounds of many government officials and parliamentarians, in the 1990s were history and languages. Furthermore, humanitarian perspectives and competence were urgently needed for the development of the country, for establishing new institutions and a new sense of identity. Simultaneously, the humanities disciplines rushed to compensate the 50-year period of oppression and underdevelopment. Therefore, the bitterness of natural scientists at the sudden privileged position of the humanities is understandable. A male stayer at a physics institute describes the changes as follows:

> *Science does not benefit from such revolutionary times. In Estonia a clear shrinking, to put it mildly, program has been established (...) it was decided that there was too much science for Estonia and they*

[2] The institutional structure was reformed in 1990s. Institutes of the former Estonian Academy of Science, the local elements of the Soviet Academy of Science which had acted as a Ministry of Science, were joined to the universities and funding decreased significantly. The Academy of Science became a body of elected individual members. The Academy is, thus, a club of research elite, which represents science in the public arena when needed, and also tries to lead the discussions concerning future research and its impact on society.

basically started annihilation of Estonian science on the national level, all those humanitarian governments (...). (P177, M/S, EST)

II. Short-sighted science policy

Many of the interviewed physicists perceived government's policy changes as short-sighted and dangerous. Priority areas have been redefined too often and the economic impact of research is expected to appear too quickly. A male stayer said:

[W]e have a very utilitarian and short-sighted national policy and long-term investments are simply not made in science and education. Well, we need to get through this period. In five years when we lose the advantage of cheap labour, the people will come back to science. Then another ten years and we can see what will happen next. (P189, M/S, EST)

III. Commercialisation

Physicists see the change from Mode 1 science to Mode 2 as mainly commercialisation of research. Commercialisation seems in the Estonian case to reach even deeper into the content layers of research than in any other country. Consequently there are two different ways that physicists see research being commercialised:

1. Demand for applicable results and co-operation with enterprises.
2. Pressure to prove efficiency at every level including basic theoretical areas of research means all research is evaluated economically; the criteria are mainly quantitative and the ISI Web of Science is often the main source of authority and basis for local decisions.

Demand and supply appear to be thorough in regulating research work. A female leaver describes it as follows:

It seems to me that the state does not support science as much as it used to. Earlier it used to finance science more. Now money goes, like, into business. The one that provides immediate results. (...) If there is no demand for a kind of theoretical knowledge, no funding is available. (P199, F/L, EST)

IV. Old workplace culture *versus* new, more democratic culture

In the old times, before the 1990s, strong charismatic leaders of the Herculean type were admired and endorsed by most of the researchers. The leaders were responsible for really large institutes and a variety of research themes. They were free to make managerial decisions. They mediated between their institute and the Academy of Science or other government institutions, and were therefore supposed to be good at lobbying and getting resources, as well as external contracts. A male stayer describes a former charismatic leader and his leadership style as follows:

> *X has always been a one-man institution, I mean, lead by a great leader. Where a great leader has designed the staff according to his plans, the staff is also able to make his plans come true. And that has perhaps, as a disadvantage, handicapped the initiative of those [staff]*. (P179, M/S, EST)

Many physicists describe their everyday work during the Soviet period as having *Worker Bee characteristics.* Physics was ideologically relatively free of control; scientists were not obliged to publish results as the head of institute was responsible for evaluating their work (P180, M/S, EST, & P197, M/S, EST). An ordinary Worker Bee researcher did not need to think about the material and human resources, funding, or the image of the research group; they were provided with materials and resources and were expected to work their best ability.

Today all research is project-based with individual researchers, as well as small and average sized teams rather than institutes competing with each other for funding. These small units now are quite independent and their main concerns are sustainability and development. The entire system is much more democratic and transparent; however, this also assumes more initiative, responsibility and entrepreneurship at the small group and individual researcher's level. Physicists interviewed for UPGEM project, responded to this change in two ways:

1. Some welcomed increased degree of democracy and appreciated the assumed responsibility and opportunities to make decisions themselves.

2. Others found the changes to be waste of time and limited resources. These scientists would prefer an elitist science policy. Instead of small short-term projects and grants that are made available for nearly everybody, larger grants would be awarded to only the absolutely top level research themes and their respective research groups. All the other research groups should, according to their view, be terminated.

V. The reasons for brain drain

The main reason for leaving career in physics for a physicist is the low level of remuneration. Low salaries are seen in the context of governments' science policies which in the political rhetoric strongly emphasises the role of science and education, but actually do too little to endorse the knowledge-economy. Indeed the knowledge-economy is mainly perceived by interviewees as political rhetoric:

> *At the moment we speak about knowledge-based economy, but at the same time there haven't been any, like, specific steps. So, if the Estonian government really plans to finance science more substantially, that it's possible that these young scientists can also be a competition to all kinds of programming companies that just take students by terribly large numbers(...)*. (P188, F/S, EST)

VI. The choice between commodity design and basic research

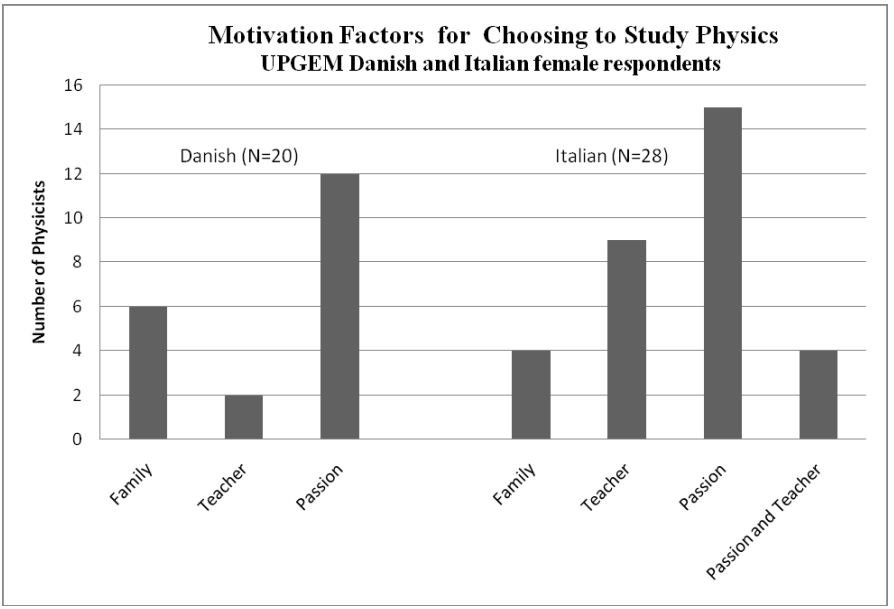
Those who have decided to continue in physics, have an opportunity to improve their economic situation as well as research conditions via establishing 'spin-off' business enterprises and focusing on creating products and commodities. A male leaver describes it as a main dilemma for a researcher:

> *The distance between basic and applied research is decreasing. There is, however, a tension between these two: "What you are working on, needs to get ready for use (...) on the other hand, you can go further, into more academic direction where you can work with things that are intellectually interesting for some reason, but have no direct application [if you get funding]*. (P187, M/S, EST)

The main issue for Estonian physicists concerning the research and education environment is the perception that science policy is too vague and hectic. The social and political changes since the early 1990s coincided with the global science policy changes which have made it hard to diagnose the real reasons and causes of the ‘brain drain’ of physicists.

13.0 Motivation for Physics

Agata Heymowski



In order to understand the question of why more female physicists leave the research field in Denmark than in Italy we looked into motivation factors behind women's choice of physics as a career in both countries. Our respondents mentioned the following three main motivation factors: family, teacher and passion. We found a difference in how Danish and Italian female physicists perceive the sense of passion about physics.

The Italians mostly mentioned a 'love for physics' in an excited way in the context of 'passion'. Some even mention their interest for physics already started at the age of 10 or 12. We did not find expressions of the

same excitement or ‘love for physics’ among the Danish female physicists, who talked about their choice of physics as a kind of curiosity rather than ‘love’. We also found an interesting aspect among many of the Italian responses in referring to their primary or high school physics teachers (particularly the female teachers) as the source of inspiration or encouragement for learning physics. By comparison, only two of the Danish female physicists spoke positively about their physics teachers or perceived them as a motivating factor for studying physics. Unfortunately, more Danish females describe their physics teachers as either ‘boring’ or ‘hopeless’.

In the context of the Danish school system, we found that the relationship between the teachers and the interviewed physicists (males as well) was generally very poor. Thus it is conceivable that an improvement in the teaching quality in the Danish schools will influence youths’ attitude to physics – first as pupils and later as scientists. As our empirical material shows, there is a pattern of many physicists getting their interest in or ‘passion’ for physics from an inspiring physics teacher.

Finally, we find the some of the Danish female leavers mentioned loss of interest for research or even physics as a reason for leaving.

Part II
Recommendations

14.0 Concluding UPGEM Recommendations

The UPGEM consortium[1] presents the recommendations based on the research conducted in the UPGEM project. The research is presented in this publication, *Draw the Line!*, as well as *The Full Collection of UPGEM National Reports* and *Break the Pattern!* and others at www.upgem.dk. The recommendations are addressed to policy makers, gender equality officers and decision makers in academia.

A great deal of gender equality research in academia focuses on women's problems. In the UPGEM project we find that women do not constitute the problem but certain, typically highly masculine, scientific workplace cultures can be problematic in terms of gender equality as these cultures can be particularly hostile to female scientists. The UPGEM partners define scientific cultures as patterns of connections that can contribute to the inclusion or exclusion of female researchers. Therefore the main research-based recommendation is to break such cultural patterns of exclusion by identifying these in the given workplace environment. In order to achieve this aim, a focus on the entire workplace environment is necessary; the consortium believes focus must be on female as well as male researchers and leaders in academia and not simply on targeting women specifically.

In addition to this overall aim of breaking the pattern, the consortium presents a number of recommendations that address specific areas concerning the workplace cultures identified in the UPGEM research. These areas are leadership, selection mechanisms, workplace environment, time management, work life balance, science and society. Firstly, we will discuss each of the UPGEM recommendations in relation to the analyses

[1] The UPGEM consortium partners presenting the recommendations are: Cathrine Hasse (co-ordinator), University of Aarhus, DPU, Denmark; Kristina Rolin, Helsinki School of Economics, Finland; Anna Maria Ajello, La Sapienza, Italy; Endla Lõhkivi, University of Tartu, Estonia and Merja Helle, University of Helsinki, Centre for Developmental Workplace Research, Finland. The recommendations have been edited by research assistants Stine Trentemøller and Anne Bjerregaard Sinding.

presented in the five national reports and the three scientific cultures, Hercules, Caretakers and Worker Bees, found across the national borders.

In order to obtain gender balance in academia a balance of the elements in the before mentioned scientific cultures is necessary. This is achieved through acknowledgement that to do good research Worker Bee-, Caretakers-, and Hercules-physicists are needed and must be equally valued. Secondly, we will discuss in what way the UPGEM recommendations contribute to the more general topics and recommendations previously presented and discussed in European Commission publications[2].

In the following we present the list of UPGEM recommendations.

14.1 The UPGEM recommendations

Scientific culture

- *Balancing workplace cultures to obtain gender balance should be the overall objective*

Leadership

- *Conception of leadership should be improved by appointing leaders, managers, and administrators according to their professional as well as social skills.*
- *All leaders and research co-ordinators must participate in human resource courses as part of the accreditation process of the university.*
- *More female leaders should be appointed to break cultural patterns*

Selection mechanisms

- *Stronger awareness of real transparency (communications and discussions of de facto selection mechanisms) of the criteria of recruitment and competitions should be established.*
- *Hiring and other decision-making committees must be educated about the influence of evaluation biases (gender, age and others) and how to counteract them.*
- *Assertion courses should be offered to researchers (female and male) if it is a means to improve a local competitive workplace environment*.

[2] The publications in question are discussed in the last section.

Workplace environment

- *Harassment (including sexual harassment) should be acknowledged as a problem for the psychological work environment of the scientific community, not just for the individual person.*

Time management

- *Time management should be seen as the responsibility/problem of the community, not the individual.*
- *Reconciliation of family/private and professional life should not be seen as a problem for the individual researcher, but as one of many possible resources for improving the academic self-enclosed workplace culture.*

Family life

- *Constraints in career paths may be overcome by new initiatives like including family subsidies for grants to scientists going abroad.*
- *Day care facilities should be as self-evident for academic planners as parking lots. Cultural patterns can be broken by offering a place in a local institute day care to the fathers as well as the mothers.*
- *Actions should be taken in order to obtain a more even distribution of parental leave between fathers and mothers.*

Science and society

- *Scientific education should aim at a better understanding of science in society.*
- *The stereotype of the male scientist should be challenged by discussing it in relation to real life conditions.*

14.2 Balancing workplace cultures

In the following we explain the reason of each of the recommendations and how they serve to secure a balance of scientific workplace cultures

Scientific culture

- *Balancing workplace cultures to obtain gender balance should be the overall objective*

This is the principal recommendation that governs the aim of the subsequent UPGEM recommendations. UPGEM has identified three types of scientific workplace cultures[3], and finds it crucial to ensure a balance of these cultures at any given workplace.

We find that some of the recommended measures which are called for in some national contexts have already been implemented in other national cultures *without* the desired improvement in women's career paths. Instead of rejecting the initiatives, we argue the recommended measures must take the nature of each local scientific culture into account and, if necessary, adjust the recommendation locally in order to turn the local cultural patterns of exclusion into patterns of inclusion.

We believe it is important to acknowledge and recognize the contributions from all three types of cultures so that elements from the Worker Bee and Caretaker culture are valued in a Hercules culture, and elements from the Caretaker and Hercules culture are valued in a Worker Bee culture just as elements from the Hercules and Worker Bee culture should be valued in a Caretakers culture. Thus to succeed in securing a better balance of the scientific cultures (Hercules, Caretakers or Worker Bees), the consortium presents the following UPGEM recommendations as measures to counterbalance cultural patterns of exclusion in the predominant scientific culture at a given workplace and thereby contribute to the existence of a fair gender balance.

[3] The three scientific workplace cultures are theoretically and empirically founded on the UPGEM research. They are defined in more detail in the publication *Break the Pattern! A critical enquiry into three scientific workplace cultures: Hercules, Caretakers and Worker Bees* (Hasse & Trentemøller (Eds.), 2008)

Leadership

- *Conception of leadership should be improved by appointing leaders, managers, and administrators according to their professional as well as social skills.*
- *All leaders and research co-ordinators must participate in human resource courses as part of the accreditation process of the university.*
- *More female leaders should be appointed to break cultural patterns*

All the UPGEM national reports show examples of defective leadership which leads to dissatisfaction and frustration in scientific staff. The reports point to a lack of strong leadership regarding healthy workplace environments, lack of support and encouragement as well as problems with new public management. The reports also mention abuse of leadership positions leading to sexual harassment, abuse of power and use of nepotism. Moreover, they report byzantine relations or small baronies which in some cases lead to suggestions to female researchers, who air their dissatisfaction, to abandon their career. Though concepts of leadership may differ from one national context to another, lack of both social skills and understanding for human resource problems in leadership seems to be a consistent problem at all the investigated workplaces. We find that women in particular seem to call for these skills, and in examples of best practice we find female leaders who seem more able to employ such skills in their management style. Therefore, we do not only recommend increased focus on social skills and humans resource when appointing and training leaders we also recommend employing more female leaders in areas where they constitute a minority.

As mentioned before, the UPGEM recommendations aim at ensuring a better balance of the three scientific cultures (Hercules, Caretakers or Worker Bees) as we argue it will ensure a better workplace environment. Lack of social skills and lack of female leadership is most salient in the Hercules culture. At a workplace with a pronounced Hercules culture it is thus important to provide a balance with Caretaker and Worker Bee elements. If the leadership can learn to connect the solicitude from the Caretaker culture with a Hercules culture, harassment is firstly likely to be reduced and secondly more likely to be seen as a concern for the leaders as

well as the colleagues and not simply as an accepted element in (hidden) competition to be dealt with individually. If leaders can learn to connect the clearly defined hierarchical decision-making characteristic of a Worker Bee culture with the anti-authoritarian elements of the Hercules culture, it will diminish the murky inclusion processes (characteristic of the Hercules culture) and ensure greater transparency in decision-making while keeping the possibility to question leadership decisions. A balanced workplace culture with collegial solicitude, transparency in decision making and the possibility to question leadership decisions can contribute to the existence of a fair gender balance.

Selection mechanisms

- *Stronger awareness of real transparency (communications and discussions of de facto selection mechanisms) of the criteria of recruitment and competitions should be established.*
- *Hiring and other decision-making committees must be educated about the influence of evaluation biases (gender, age and others) and how to counteract them.*
- *Assertion courses should be offered to researchers (female and male) if it is a means to improve a local competitive workplace environment*.

All the national reports show examples of selection mechanisms which lead to dissatisfaction and frustration. The interviewed scientists have experienced disguised mechanisms that result in unfair conditions in their everyday work life and fewer opportunities to climb the career ladder. One example is the culture of long working hours which is problematic because much information is shared informally among those who stay at the workplace till late in the evening. The tacit mechanisms strike the men and women in our research as deeply problematic, but it seems to hit the women harder than the men. Therefore, we recommend awareness of real transparency. One step is to establish more formal information sharing practices. Selection committees should also be educated in increased awareness of the influence of evaluation biases. Moreover, we recommend that selection committees are responsible for transparency to another authority in the university. Employees who feel they have been treated

unfairly should have an authority in the university management to which they can turn. We recommend that assertion courses are offered to female physicists in cases where they down-grade themselves due to excessive modesty and seemingly a lack of self-esteem. When we look at statements from leavers, we find that in some contexts male researchers would also benefit from assertion courses.

With respect to the three scientific cultures we find that lack of transparent selection mechanisms is primarily a problem in the Hercules and Caretaker cultures. In the Hercules culture, hidden competition and harassment constitute tacitly accepted elements in the selection processes. In the Caretakers culture, nepotism and favours seem to be equally accepted. These cultures would benefit from a balance with the transparency of the Worker Bee culture. In the Worker Bee culture, however, transparent selection mechanisms rest solely on hierarchical power structures wherefore male and female Worker Bee scientists are not expected to be assertive. In Caretaker cultures, the male and female scientists are not expected to question decisions made by the group. Therefore, both the Worker Bee and a Caretaker culture should connect with the acceptance of open challenge of selection mechanisms found in Hercules cultures. A balanced workplace culture with transparent selection mechanisms, the possibility to question these selection mechanisms and a workplace environment that sustains the self-esteem of the employees can contribute to the existence of a fair gender balance.

Workplace environment

- *Harassment (including sexual harassment) should be acknowledged as a problem for the psychological work environment of the scientific community, not just for the individual person.*

In each of the UPGEM countries, the research has found examples of outright harassment (including sexual harassment) of scientists by fellow scientists or leaders. Harassment creates an imbalance in well-functioning workplace cultures. Therefore, we recommend that the entire workplace environment, with leaders in front, take responsibility for solving cases of harassment and improve the psychological climate of the workplace.

In terms of the three scientific cultures, we find that in the Hercules culture many of the tacitly accepted elements in the hidden competition and in the selection mechanisms mentioned above constitute harassment. Moreover, no particular steps are taken to prevent harassment because it is seen as an inevitable aspect of the academic environment. This makes harassment a problem of the individual to be solved somehow by the harassed persons themselves. In Worker Been cultures harassment is passively accepted as a consequence of the strong leadership over powerless employees. Both of these cultures should learn to connect with the social responsibility found in Caretaker groups. Here harassment is seen as a disturbance of the entire group and therefore a social responsibility. The entire group must deal with the issue rather than leave it as a problem of the individual. Caretakers have colleagues to turn to in the group; they will support each other in addressing the harasser. Caretakers might, however, be prone to accept some degree of suppressive conduct in order not to disturb the group dynamics. A balanced workplace culture with group responsibility for harassment and a will to raise awareness of these cases can contribute to the existence of a fair gender balance.

Time management

- *Time management should be seen as the responsibility/problem of the community, not the individual.*
- *Reconciliation of family/private and professional life should not be seen as a problem for the individual researcher, but as one of many possible resources for improving the academic self-enclosed workplace culture.*

All the UPGEM national reports show examples of time management constituting a problem particularly for female scientists and for male scientists identified as 'new masculinities'.

The UPGEM consortium wishes to challenge the culture of seeing long working hours as desirable; it is not the number of hours that count in good science. The important element that counts is what scientists get done during their working hours. In other words, universities need to invest in efficiency, not in over-working their staff. Time management should be seen as a concern for the whole community, and the wish to set aside time

for family life or other engagements outside physics should be seen as a resource for the research community rather than a defect in the individual researcher.

Regarding the three scientific cultures, we find that in the Worker Bee culture the scientists find it less problematic to combine work and family life. Working hours are clearly demarcated which makes it possible to plan the connection between work and family life. The Worker Bee culture, however, would benefit learning from Caretakers that family life can be connected with work life. Work is planned together with the rest of the group, but the time and place of the execution of work is up to the individual group member. Working hours are flexible and borders between work and free time are blurred. In this culture working at home is more accepted than in the other two cultures. Time management is a particular problem in a Hercules culture in which scientists show full devotion to research by working round the clock at the workplace. In a Hercules culture, scientist cannot introduce elements from outside physics as it is seen as an intrusion which will exclude the scientist from the 'bubble of physics'. A Hercules culture would benefit from learning to connect with the more transparent or family friendly workplace culture known in the Worker Bee and Caretaker cultures. The Hercules as well as the Worker Bee cultures could learn from the Caretaker scientists who connect work life with being a 'whole person'. This makes it possible to draw resources from a person's entire life experiences into science and thus enrich the scientific environment. A balanced workplace culture with group responsibility for time management and an acceptance of a life outside physics can contribute to the existence of a fair gender balance.

Family life

- *Constraints in career paths may be overcome by new initiatives like including family subsidies for grants to scientists going abroad.*
- *Day care facilities should be as self-evident for academic planners as parking lots. Cultural patterns can be broken by offering a place in a local institute day care to the fathers as well as the mothers.*
- *Actions should be taken in order to obtain a more even distribution of parental leave between fathers and mothers.*

All the UPGEM national reports show examples of how women especially, but in cases of new masculinities also men, consider children an obstacle for a scientific career. Yet, through in-depth analysis of the research material we find that children are not the origin of the problem of women's scientific career track. In some UPGEM countries the scientists seem to be able to combine family and work better than in other UPGEM countries. In the former context, many successful female professors have children, whereas few of the female leavers have children. What we find to be important is the culturally influenced perception of children in the workplace environment. To ensure connections, which make it possible to combine work and family life we suggest initiatives such as including family subsidies or grants to scientists going abroad, better day care facilities and a more even distribution of parental leave between fathers and mothers.

All three recommendations aim at ensuring a better balance of the three scientific cultures as it will ensure a better gender balance. However, our research shows that some of the above recommendations have already been implemented at certain workplaces *without* generating the desired connection between children, family and work. Therefore, it is important to take into consideration the prevailing scientific culture of the local workplace when assessing the need to adjust the measures locally in order to break cultural patterns and develop new ones.

In a Hercules culture, family life and children are seen as disturbances in the physics bubble. Gender and family responsibilities can be used negatively in competition and are thus contested. Neither women nor men are tied to traditional gender roles. But especially women have to fight for a right to be perceived as 'good' physicists as well as 'good' parents. The Hercules culture could change if the culture learns to see family life as an asset in physics research, as it is the case in a Caretakers culture. In a Worker Bee culture family issues are understood as the problem of the individual researcher, but it is accepted that Worker Bees leave the workplace to take care of children. When women prefer to take the primary responsibility for childcare they benefit from being part of either a Worker Bee culture or a Caretaker culture as it is easer to combine work and traditional gender roles in these cultures. In cases where female scientists do not wish to carry the main responsibility for childcare and household, a

Worker Bee and Caretaker culture will be problematic because traditional gender roles are not contested in these cultures as they are in the Hercules culture. Therefore, we find the paradox that new masculinities emerge in the Hercules culture but are excluded because they challenge the concept of the enclosed physics bubble. A balanced workplace culture with acceptance of children and family without keeping women in the traditional gender roles can enrich the workplace and contribute to the existence of a fair gender balance.

Science and society

- *Scientific education should aim at a better understanding of science in society.*
- *The stereotype of the male scientist should be challenged by discussing it in relation to real life conditions.*

Each of the UPGEM national reports show examples of physicists who complain that science is not well understood in society. We also see a new (nascent) understanding that scientists should be better at understanding their role in society. Physicists generally encounter a societal stereotype which depicts scientists as isolated (either as nerdy or mad) and always as male scientists. But many scientists, especially the women, do not mirror themselves in the image of the nerdy or mad male scientist. Therefore we recommend a twofold approach to change the perception of scientists in society and the scientists' perception of science in society: Education in science should aim at a better understanding of science in society and the stereotype of the male scientist should be challenged by discussing it in relation to real life conditions

With respect to the three scientific cultures we find that in a Caretaker culture the physicists see science as embedded in society; the interests of science is congruent with the interests of the common good. In a Hercules culture, the surrounding society is viewed as irrelevant to the 'physics bubble'; science should move ahead according to internal interests rather than including societal aspects. If the Hercules physicists could learn to connect with some of the elements in the Caretaker culture it would create a more encompassing environment. In Worker Bee cultures, the connection to society is through their top leaders rather than discussing among them-

selves the usefulness of their research to the common good. This culture could also learn to connect the Caretakers' care for the society as a whole with their research. Due to the little interest in societal acceptance, the Hercules physicist accepts and, to some extent, praises the image of the isolated nerd. Caretakers and Worker Bees both distance themselves from the stereotype of the nerdy/mad isolated scientist and are therefore more willing to attempt to break this cultural pattern. A balance workplace culture which is able to integrate societal interests in research activities and distances itself from male stereotypes and thereby contribute to the existence of a fair gender balance.

14.3 UPGEM recommendations in context

In this section, we discuss the aim and research foundation of a number of recommendations put forth by other researchers[4]. The reader will notice that many of the recommendations suggested over time are relatively similar and closely related. This suggests that though some progress is happening in the field of gender equality in academia the steps are too few.

The suggestions discussed below relate to the European context wherefore we have found it interesting to correlate with the UPGEM recommendations. Apart from two significant aspects, the UPGEM recommendations resemble to some degree the suggestions made by others. One difference is that the UPGEM recommendations are formulated/ phrased on the bases of a comprehensive empirically based qualitative data material (in-depth interviews with 238 physicists). The other difference is that this qualitative data holds information why elements from previous recommendations have not been implemented in practice. This information is integrated into the principal UPGEM recommendation, which stresses the importance of taking account of the predominant local workplace culture and from that outset implement the necessary elements from the other recommendations to ensure equilibrium of all three scientific workplace cultures identified in the UPGEM data and thereby ensure gender equality.

[4] A special thank to Anne Bjerregaard Sinding for her great effort in outlining existing recommendations.

At EU level, the under-representation of women in scientific careers has been an increasing cause for concern. The results of the UPGEM project support many of the findings already presented by the European Commission.

In 1999, the European Commission adopted an action plan to promote gender equality in science (*Women and Science – mobilising women to enrich European research*). The Commission authorized a European Technology Assessment Network (ETAN) report on women and science. Moreover, member states were invited to establish baseline data on the gender balance of research and development personnel and to explore procedures and methods for data collection to measure the participation of women in European research (Rees, 2002, p. 5).

At the end of 1999, the Helsinki Group on Women and Science was established by the European Commission. The group was comprised of gender experts and civil servants from the 15 EU member states at the time, as well as 15 countries associated with the Fifth Framework Programme[5]. The Helsinki Group was set up to focus on women and science with the mandate of promoting discussions and exchanging experiences on policies and measures devised and implemented at all levels in the EU (local, regional, national and European level). Furthermore, in order to monitor the participation of women in European research, the group was also asked to provide national sex-disaggregated statistics and to develop gender sensitive indicators (ibid., p. 5).

In 2003, the *SHE Figures* was launched by the Women and Science Unit of the Directorate General for Research in order to establish a rolling record that would be useful in mapping progress towards gender equality in science. The *SHE Figures* (European Commission, 2004a; European Commission, 2006) have broadened the existing base of descriptive statistics and provided access to data on the participation of women as graduates, academic staff, funding beneficiaries and members of scientific boards (European Commission, 2006).

A recent study (European Commission, 2008b), which has benchmarked policy measures for gender equality in science in the EU (including its associated members and the Western Balkan region), shows that in 2004,

[5] The Fifth Framework Programme of the European Community for research, technological development and demonstration activities, 1998-2002.

women full professors in science make up a proportion greater than 20% in only five countries (Romania, Turkey, Latvia, Portugal and Finland). For the remaining 25 countries - which include four of the five UPGEM countries - it seems unlikely they will reach the 25% target by 2010 which was recommended by the European Commission in 2005 (see European Commission, 2005b). Moreover, the statistical and policy analyses of this study indicate that inequality in the gender division of tasks relating to family and household care hinders women's participation in science. Therefore it recommends that "fundamental work-life balance solutions for dual-career couples and single parents need to be implemented" (European Commission, 2008b, p. 39) to achieve equal participation of men and women.

The UPGEM research differs from the above in being based on 'close-up' studies within one particular field (physics) focusing on both stayers and leavers. The former group of physicists is included in the above mentioned statistics whereas the latter has not so far been included in statistics of women in science. Through qualitative interviews with (randomly chosen) female physicists (stayers and leavers) in the five UPGEM countries, these women are given a voice and a chance to shed light on the actual reasons behind the low numbers of women in physics. By contributing to the understanding of the low representation of women with qualitative methods of interviews and participant observation, UPGEM has got into some of the many complex back stage factors that can shed light on what lies beneath the numbers of the quantitative studies.

Furthermore, the qualitative approach has made it possible to develop new perspectives on selection mechanisms in academia by investigating selection mechanisms in the *everyday life* of male and female researchers at universities in Europe.

The debate about selection mechanisms was initiated by, among others, a Swedish study in 1997 (Wennerås & Wold, 1997) of research funding. Wennerås and Wold discovered gender bias in the way in which research awards were given. The study showed that women had to be 2.2 times more productive than their male colleagues to be as successful in securing financial support for their research. Wennerås' and Wold's study marked a turning point in Europe; the documented proof of discrimination against women could no longer be ignored by universities and governments. What

is more, the absence of women in science could now be explained as connected to the institutions rather than to the women themselves.

By focussing on the everyday life in the workplace cultures at physics institutions, the UPGEM analyses show that tacit selection mechanisms are as much an element in everyday life as the explicit evaluations in selection committees. We find a close connection between the scientific culture, human resource development and selection mechanisms wherefore further investigation of selection mechanisms is crucial. Moreover it pertains to issues of deep concern for the Commission.

In January 2000, the European Commission in establishing the European Research Area (ERA) acknowledged the need to introduce a European dimension to careers. In March, it was followed by the Lisbon Agenda in which the European Council agreed upon making "Europe the most dynamic and competitive knowledge economy in the world by 2010" (Lisbon Council Conclusions, 2000). The Sixth Framework Programme, which has financed the UPGEM project, was aimed at paving the way towards the ERA.

In 2004, The High Level Group on Increasing Human Resources for Science and Technology was set up aiming to identify specific actions and policy measures in order to increase the number of research personnel in Europe. The independent group's report (European Commission, 2004b) recommended giving close attention to the reasons why women 'leak out'. It stressed the need to incorporate appropriate strategies to keep the women in the environment. Recommendations serving this aim included, among others, "encouraging a change in work culture, with emphasis on policies and support systems that favour the integration of work and life outside work for women and men. This could include, for example, new models for childcare, flexible working hours and places, support for re-entries (after maternity leave), and support for family mobility (not only for one member of the family)…" (ibid., p. 178). Furthermore, it included "mechanisms for involving women scientists more actively in the **policy process** [authors emphasis], and in designing and managing research programmes and resources, at national and European levels" (ibid., p. 178). Support in this respect could be provided through networking and mentoring systems. The report also recommended measures to engage both girls and young women in science "by taking account of gender differences in science teaching,

improving the image of science, engineering and technology, and adapting careers materials and services to attract girls and young women into scientific professions" (ibid., p. 178)

With the instrument of the three culture types, Hercules, Caretakers and Worker Bees, and a focus on the need for a balance of these three types of cultures in the workplace, UPGEM provides a tool for the practical implementation of change in workplace cultures. This instrument is based on research in the reasons why women 'leak out' – a process which to some extent we find is more adequately described as a push/pull effect. When individual scientists try to find a place in particular workplace cultures they can either be pushed out if they are not perceived as fitting the given scientific culture or pulled in if they have the needed skills. The UPGEM recommendations suggest changes in the workplaces which are very similar to the ones of the High Level Group (European Commission, 2004b). However, based on in-depth analysis of the qualitative empirical data, the UPGEM consortium argues that a change in the workplace culture also requires a change in the mindset in academia if the recommended changes are to have any effect. It is not enough to point out the changes needed, it is more important to stress how these changes can come about; in this process it is important to correlate with the prevailing workplace culture.

In 2004, the Lisbon objectives were reinforced by the European Council stating that "Human resources are critical for R&D and priority must be given to training, retention and mobility of researchers" (Presidency Conclusions European Council 25–26 March 2004, p. 7). Moreover, *The European Charter for Researchers. The Code of Conduct for the Recruitment of Researchers* (European Commission, 2005a) included a set of basic principles which should be followed by funders and employers in the Member States when appointing or recruiting researchers. Among other things, the charter recommended the EU Member States to take crucial steps to "ensure that employers or funders of researchers improve the recruitment methods and career evaluation/appraisal systems in order to create a more transparent, open, equal and internationally accepted system of recruitment and career development as a prerequisite for a genuine European labour market for researchers" (ibid., p. 6). With regard to working conditions, the charter also recommended that employers should "aim to provide working conditions which allow both women and men

researchers to combine family and work, children and career". Particular attention should be paid, inter alia, to flexible working hours, part-time working, tele-working and sabbatical leave, as well as to the necessary financial and administrative provisions governing such arrangements" (ibid., p. 17). Furthermore, it was recommended that employers should "aim for a representative gender balance at all levels of staff, including at supervisory and managerial level (…) achieved on the basis of an equal opportunity policy at recruitment and at the subsequent career stages without (…) taking precedence over quality and competence criteria. To ensure equal treatment selection and evaluation committees should have an adequate gender balance" (ibid., p. 18).

Like the European Charter for Researchers, the UPGEM recommendations also set standards with respect to recruitment and treatment of researchers. Some of the UPGEM recommendations are very similar to the ones in the afore mentioned charter. Yet, it is important to note that the UPGEM research substantiates the principles and recommendations with empirically based results which illustrate the way in which the selection system is not transparent today and at the same time give access to what is meant by a more transparent system of recruitment. Similarly the empirically based research can shed light on the types of problems that are perceived to be connected with combining work and family life.

Recently, the WIRDEM Expert Group (European Commission, 2008a) has been given the task to "review procedures for evaluating and promoting research personnel and to identify examples of good practice at national and institutional levels", and to identify "which measures have proven successful and which are not, and the reasons for this, and to determine whether transparent and fair evaluation and promotion procedures alone are sufficient to improve gender balance in research decision-making positions" (ibid., p. 6). In their report, *Mapping the Maze: Getting more women to the top in research*, which is based on eight case studies, the WIRDEM Expert Group stresses that equality is part of quality in science. Accordingly, they recommend that "the scientific community should take measures to systematically introduce the gender perspective in human resource development and in future research (…) because a gender perspective would bring out the subtle and hidden mechanisms that prevent women from developing academic careers on equal terms and would facilitate

deeper changes in the structure and organisation of the academic structures (…)" (ibid., p. 3). The report also stresses the widespread ignorance and denial of the problem of gender inequality in science, which results in extremely little change. Therefore, they recommend the training of new leaders on the gender aspects of their work as it "cannot be taken for granted that people already know all they need to know, and can effectively resist pervasive gender stereotypes" (ibid., p. 38). Moreover, with respect to the work/life balance for both male and female scientists it is recommended to provide "sufficient child care facilities and assessing, and eventually changing, time-policies and time-cultures in scientific organisations, tackling negative images of working mothers and promoting active fatherhood, which would allow science to move away from the image of a scientist without family responsibilities and needs" (ibid., p. 39) In terms of recruitment, the scientific community should "establish and implement transparent procedures with clear quality criteria in selection and appointment processes and quality assessment, in order to avoid bias or subtle discrimination" (ibid., p. 39).

On May 21, 2008, a resolution of the European Parliament on women and science[6] was passed. The resolution points to the fact that the European Research Council (ERC), with only five female members out of 22 on the ERC Board, has not achieved a gender balance. The resolution draws attention to the fact that education systems in the EU "continue to sustain gender stereotypes, in particular in areas of research such as the natural sciences"[7]. The resolution also outlines that conventional approaches to evaluation of excellence and performance as corresponding with the number of publications might not be gender neutral as they fail to take account of other resources available. With respect to gender and leadership, the European Commission is called on to provide "targeted gender-awareness training for those in decision-making positions"[8] (that is advisory boards, evaluation panels etc.). Moreover, the resolution suggests

[6] http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P6-TA-2008-0221+0+DOC+XML+V0//EN Retrieved 9 Sept 2008

[7] See sentence '1' at http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P6-TA-2008-0221+0+DOC+XML+V0//EN Retrieved 9 Sept 2008

[8] See sentence '17' at http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P6-TA-2008-0221+0+DOC+XML+V0//EN Retrieved 9 Sept 2008

that age together with family situation is to be taken into account as a criterion for excellence in order to balance the negative impacts on women's career opportunities, which comes from taking breaks for family reasons. The Commission and the Member States are called on to improve work and family life reconciliation for researchers through possibilities for flexible working hours and improved child-care facilities and calls for "parental leave conditions that genuinely allow men and women freedom of choice" and stresses that "reconciling work and family life is the responsibility of both men and women"[9].

14.4 Concluding comment

As mentioned, many research based recommendations and initiatives have been repeated over time, and many of these recommendations are indeed largely in line with the UPGEM recommendations.

However, the UPGEM project contributes to this field with new perspectives on everyday life in academia. On the basis of the qualitative data material, and awareness of the necessity to focus on the entire the working place environment, our analyses have outlined the existence and workings of the exclusion mechanisms in academia work. Thereby, the consortium is able to suggest a tangible solution to the implementation of the UPGEM recommendations. The essence of this solution is to work with a theoretically founded understanding of scientific cultures and consider the fact that different workplaces can have different cultures wherefore different steps may be needed to ensure a fair gender balance. Consequently, we do not perceive our recommendations to be directly applicable in all contexts rather we argue that, if necessary, the recommendation must be adjusted locally as required by the predominant local scientific culture.

In order to obtain the desired transparent procedures and make people aware of gender perspectives, UPGEM suggests working specifically with identifying the prevailing scientific culture before taking steps to balancing this with elements from the other scientific cultures. The introduction of the

[9] See sentence '10' at http://www.europarl.europa.eu/sides/getDoc.do?pubRef=-//EP//TEXT+TA+P6-TA-2008-0221+0+DOC+XML+V0//EN Retrieved 9 Sept 2008

three culture types, Hercules, Caretakers and Worker Bees, serves as an instrument to achieve this aim.

1) By asking people to identify their own workplace in relation to the three culture types and discuss gender in relation to this identification we bring awareness of gender perspective into the scientific culture in a very concrete manner.
2) By placing focus on gender perspectives embedded in the given workplace culture and the need to balance workplace cultures, we open the way for making gender related issues an issue to be addressed by the entire workplace environment.

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ANNEXES

Annex I: Summary of the Five UPGEM National Reports

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DENMARK

In Denmark, the world of politics has had great influence in the history of physics, and is still influential on any changes at the academic levels, determining the areas of the greatest success and those which are less popular. The interdisciplinary sectors of physics which have emerged in recent years have, therefore, responded to political stimuli towards projects which have a clearer and more immediate application. Male stayers speak more about these changes than women, both stayers and leavers, and they often refer to them in a negative sense, especially those with high seniority.

In regard to the reason which induces them to undertake a career in physics, women refer to the importance of a member of the family, whereas the men more frequently refer to an intrinsic interest in the subject. Friendly teachers, both at high school and university, have had more of a key-role in the career paths of the women, while the role of a mentor was or still is important for many of the interviewees, of both sexes. Although both men and women express a deep interest in and love for physics, women have a more pragmatic approach to the subject than men, who express an intrinsic interest and fascination with the fact that 'everything is physics'.

The widespread stereotype of the physicist in Denmark is that of an extremely intelligent and eccentric person, who takes little care of his appearance, but none of the physicists interviewed, fully identifies themselves with this figure.

Women are less willing to compete and to recognize the importance of competition compared to men, even though in some cases they describe themselves as competitive and well-disposed towards transparent competition. On the other hand, harassment connected to negative competition concerns women more than men. In some best practice groups, procedures have been developed to favour positive competition, which maybe a factor

in the significantly higher proportion of women in these groups than would be compared to other research groups in Denmark.

Episodes of sexual harassment are often quoted in interviews, and the risk of sexual harassment leads women to be on their guard in order to avoid potentially dangerous situations. It is up to the women to anticipate and consequently oppose episodes of this kind.

Children are seen as an obstacle mainly to the advancement of women's careers and this might explain, at least in part, the fact that in the Danish sample the greatest number of children is to be found among leavers. A point must be emphasised concerning double star (endogamic) relationships[1]. This type of relationship does not always facilitate the organization of working times and the time to dedicate to the family. Several of the leavers are in an endogamic relationship. In regards to children, another problem is maternity leave, which the physicists argue, inevitably leads to a difficult to make up career-advancement gap, which is a problem mostly for women, who account for 95% of parental leave. Even though going abroad is often linked to possible career advancement, this is often avoided, or at least reduced in terms of the length of a stay, on account of the difficulty of combining it with having children.

Interviewees with children often quoted short-term contracts as the reason for leaving university research. In general, however, leavers considered jobs outside university more family-friendly, and also in terms of time management. The issue of pay is often linked to the parental wish to provide a certain living standard for the nuclear family, and this is a reason for complaint for many interviewees, both stayers and leavers. Low salaries, therefore, prove to be one of the explicit reasons why people leave university research, even if it is rarely the only factor. However, stayers of both sexes commonly accept that this type of work is not undertaken to become rich, but to satisfy an intellectual curiosity and for passion. Beside the problem of short-term contracts, one of the most frequent reasons for abandoning university research is the lack of appointments and the opportunity to find permanent posts outside the university.

[1] The hypothesis of "double star" (endogamic) relationships was that women in "double star" relationships in physics remain in a comparatively more junior position than their partner. See the conference publication *Draw the Line!* p. 94

FINLAND

The greatest changes in the world of physics related by interviewees are twofold. The first concerns the development of information and communication technology, which is reflected in several sectors of research. The seconds concerns the complex dynamics of research funding, which are often linked to both political trends and the important movement from 'management by budget' to 'management by results', concomitant with the inevitable implications at the organization and administration levels of the universities.

The family affects the working life of women more than the men's careers. The burden of tasks in the family is borne mostly by the women, who for this reason limit their work ambitions or even leave due to the difficulties of combining working times with those of the family. In talking about their career paths, women prefer administrative and bureaucratic jobs more often than men, who prefer to take jobs in research.

The issue of interaction in the work environment draws out the most evident gender differences. Women show a positive disposition towards teamwork and collegial interaction. At the same time gender discrimination and sexual harassment concerns the women more deeply than the men. Socially accepted ways of interacting are connoted in male terms and this is also the case in respect of sexual harassment, as the women have the responsibility to adapt or to keep potentially dangerous situations under control.

As for the most common stereotype of the physicist, the figure is that of the nerd, an introverted, overspecialized scientist, but the majority of those interviewed do not recognize themselves in this figure. Generally the men are more aware of the inner boundaries and of the hierarchies between the different areas of research in physics than their female colleagues.

Competition, from the male point of view, is considered a normal component of work, with both positive and negative implications. The women, however, are less discerning on this issue. They either have difficulty recognizing competition in their career paths, or else they carefully avoid it. The avoidance of competition seems in some way to compromise their opportunities for career advancement.

As for the motive behind their choice of physics, the majority quoted scholastic experiences as important factors; more specifically, a good

physics teacher was frequently quoted as the inspiring factor in their choice of entering the faculty of physics at university. In other cases, the motive comes from significant familial figures (parents, grandparents or other relatives), who encouraged interest for the subject in the interviewees from childhood. The decision to undertake an academic career in physics after university is due to a sort of "driftwood theory", or to the fact of having seen this type of career path as the only alternative. The subdivision of interviewees into those whose motivation towards research is oriented more towards its practical application and social utility and those who are less interested in the practical impetus is of notable interest. The latter grouping is linked to the traditional idea of the physicist keen on research for its own sake and consists mostly of male stayers. The former group is composed mainly of women and leavers.

The decision to abandon this kind of career is the result of a series of pre-existing factors, varying from the work environment to the interviewees' private lives. The most incisive 'push' factor is the lack of career opportunities in Finnish universities. Secondary 'push' factors are problems connected to motivation, negative work atmosphere, competition between departments, low salaries, insufficient supervision, poor organization of work, and lack of prestige. Satisfaction or dissatisfaction with working conditions at university is the core difference between stayers and leavers. Job security, better pay and greater career opportunities are the main reasons for leaving university research.

The point must be emphasised that in the Finnish sample, the men and women do not form monolithic groups. Nevertheless many differences are evident within each of the two divisions. For example, women without children are more inclined to invest in a career than female colleagues with children, as are the men with children who have decided to abandon research in order to manage their working times better in order to dedicate more to the family.

ESTONIA

The world of physics in Estonia, the internal culture, the way of thinking and the institution, has endured great changes since independence from the Soviet Union in the early 1990s. The achievement of Estonia's independence, with its consequent political and economic upheavals, has also had

great resonance in the physics research sector in terms of economic resources and funding. The decline in the availability of jobs and the size of salaries in scientific areas, together with the emergence of new areas of work opportunities, has led many people to abandon physics as a career in favour of other, more proficient jobs, such as politics or the business sector.

Besides this, the community of physicists has preferred to concentrate resources on fewer topics in a kind of natural defence mechanism (to keep the existing physicists in work) rather than judiciously distributing resources among the various areas of research and thus create new jobs for young physicists.

Concerning the identity of the physicist, this is connoted in purely male terms and three types of physicist can be identified:

- a priest of truth: the seeker of superior knowledge
- a playful boy
- a blacksmith: a down-to-earth, practical person who truly enjoys experimenting, and working in the palpable and visible physical world.

These metaphors are useful in order to understand the shared values and the different career paths. The interviewees, however, often had the characteristics of more than one of these three types. The women identify mostly with the idea of the 'priest of truth' and felt to be very distant from the image of the physicist as a blacksmith.

In regard to the working environment, the concern is complicated by the variety of issues involved: the quality and quantity of equipment; relationships between colleagues: and the prevailing atmosphere in the workplace all of which can be immeasurably complicated as part of a remembered 'past' of sufficient comparison (the Soviet era). The Estonian physicists appreciate greatly the ability to freely choose the locations which their type of work allows and their working hours. However, they also express that they miss aspects of social communication and intellectual exchange. The impression is that they are quite isolated one from one another and this isolation affects the women a lot more than the men.

Discussions regarding personal or family matters are absent in this work environment and the interviewees of both sexes tend to give rather concise answers on these matters. The men think that private lives should not be discussed at work, but other matters. Women, on the other hand, think that

family matters are not discussed very much due to the low number of women in this environment, and because men generally do not discuss these matters between colleagues. The role of mentor can evidently be filled by different figures: a supervisor, a fiancée, a father, a mother or a member of a study and work group. Although this figure is not seen as absolutely fundamental, women's careers are more dependent on a supervisor/mentor than those of their male colleagues.

Both the men and women think that physicists consider the family important, even if their contribution to the management of home and family is different. Many women have, in fact, a greater responsibility in looking after the house and children, whereas the men attend more to the family's economic security (which reflects the general situation in Estonia). As far as sharing domestic and family tasks is concerned, a difference is beginning to emerge among the younger generations, who have a fairer and more balanced view of task-sharing between men and women. For most female physicists their maternity leave lasted from a couple of months to a year. Some of those women who had taken a short period of maternity leave say that they managed, during the first year, to work mostly from home. The role of parents in the choice of physics does not have any great importance in the Estonian data. The women in a 'double star' relationship emphasized the importance of being married to a physicist, in order to have support and encouragement on their career path or, in some cases, in the choice of which sector of physics to specialize in.

The key reasons for leaving physics, after Estonia regained independence, are clearly the economic issue (Estonia's Gross Domestic Product is, according IMF, three times smaller than Finland's), and consequently the low salaries. This problem concerns only the men, (probably because theirs is still the role of the breadwinner in Estonian society).

In regard to mobility, travelling is considered as essential for scientists by Estonian physicists. The men, however, tell of longer periods spent abroad, than their female colleagues, for which reason they view the necessity to go abroad in a more negative light, and mostly for the effects it can have on family life.

POLAND

The 'golden age' of Polish physics, especially particle physics and high energies physics began to wane with the fall of the Communist regime and the end of the Cold War. The general economic crisis of the early 1990s and the subsequent drastic cuts in the Defence budget, which had, during the Soviet period, financed many research programmes in nuclear physics, were reflected in considerable funding reductions for scientific research. This substantial reduction of government funds necessitated reducing the time spent on pure research in order to seek alternative funding sources and to manage the various bureaucratic aspects. The stability of contracts was also a major change. Permanent contracts could no longer be taken for granted and physicists found themselves competing not only for funding for their projects, but also for contracts and university appointments. Besides financial cuts, which created enormous hardship for many research institutes, the image of the scientist and science in society also suffered a sharp decline.

As for the reasons for choosing physics, the parental family has an important role, above all in instilling an interest in science from childhood. The majority view was that their curiosity towards the subject developed quite early on, thanks to the 'scientific atmosphere' at home. A father-figure especially has a key-role. During the years at school the physics teacher takes on an important role in the development of a further interest in the subject. These two figures, the parental and the role model have a greater importance for the women than for the men, who have a more independent approach to physics. Regarding the choice to study physics, men speak of this in terms of a natural continuation of their scientific interest, whereas the decision for the women is more complicated, often the result of giving up the study of other subjects.

As regards the problem of reconciling work and a family, the interviewees are not a homogeneous group. A diversity of factors determines which activity takes priority, such as gender, parenthood, age and position at university. Most of the men either do not mention this as a problem or do not speak of this as a particularly difficult problem to solve; whereas the women are divided equally between those who consider it a problem and those who do not refer particular difficulties. Generally the family is held in great consideration, even if the general feeling of both genders is that the

women suffer more in balancing work with a family. Mobility is considered a problem by the majority of interviewees, especially in association with familial commitments. In this regard, the women give concrete examples, referring to their own lives, of giving up the idea of travelling and periods abroad, while the men speak hypothetically.

Incidences of gender discrimination in the work environment are quite evident; even if the women are not always aware of it, incidences of this kind are recognizable in their accounts. For their part, the men do not feel that they have suffered discrimination, but they are capable of recognizing the discrimination suffered by women in this environment. Only one episode of sexual harassment was referred to in the interviews and the general view, of both sexes, was surprise if they did hear about problems of this type in their environment. The attitude, that teaching university students is also an inconvenience regarding research work, is held mostly by women. The women are also in the majority when mentioning the instability of work contracts as one of the main reasons for leaving.

Economic issues as 'push' factors are mentioned by the male leavers whereas the women quoted a variety of secondary factors including unsatisfactory relations with the supervisor, difficulty in combining work with family commitments and the shortage of permanent posts. Certainly the political changes which the country has undergone have not always led to positive consequences in the research sector which in combination with the emergence of more remunerative work sectors outside the university sector are likely to be key factors behind the Polish 'brain drain'.

ITALY

The most cited change in the university research sector is the shortage of funding allocations and the consequential lack of work prospects is the issue of the greatest concern. Another discernible change is the decline in the number of enrolments at the faculty of physics, which is due in part to funding issues; but also when regarding university as a formative agency, emphasis is placed on the falling standards of the students' qualifications as a result of the Bologna "3 plus 2" reform. Other significant changes concern the progress made regarding equipment and the dimensions of experiments, which at present can involve thousands of people, thus modifying the working dimension.

Concerning the career path, family members, mainly male relatives, and physics teachers are influential in the choice of physics as a career, or at least as a university faculty. Moreover, it has been easier for older researchers to climb the career ladder than for younger generations: the former were temporary only for a few years, whereas the latter complained about long, stressful periods of temporary work. The importance of teaching and of having good relationships with the younger generation was emphasized especially by women stayers.

Italian physicists irrespective of status (stayer/leaver), gender or research field like their jobs. In regard to the workplace environment, stayers expressed dissatisfaction with their working contract conditions. The biggest problems are competitive examinations, which are few in number and with little regard for meritocracy. Italian physicists experience both "constructive competition", which offers positive challenges, and "keen competition" which they consider to be unproductive. Women spoke about discrimination more than men.

One discriminating factor is the family, because the tasks related to the home and children are mainly women's responsibility, and child-birth. Maternity leave, an enforced absence from research work, is nevertheless considered as a disadvantage which affects the women mostly. Moreover maternity leave is not provided for by most fellowships. Physicists' parents are of great importance because they support their children through academia and the low salaries of temporary contracts, and because they later compensate for the lack of day nurseries. The birth of a baby makes life more complicated, but women face the biggest problems. The key problem is that children are not seen as beneficial to career advancement.

Most women travel less when they become mothers, although endogamic (double star) couples have a mobility advantage. There is a distinct correlation between the decision to leave research and the desire to have a family.

Sexual harassment in the work-place does exist, according to older generation physicists although some respondents claimed to have never heard of any incidents. Nevertheless some of their female colleagues feel it necessary to wear an alter ego when relating to their male colleagues.

The stereotype of the physicist is a male genius, creative and not understood, a person who 'lives in a world apart', absent-minded and shabby in

appearance. Most male interviewees said that they recognize themselves in this stereotype, while most female interviewees stated that they do not. For both women and men the role model was a man, mainly because so far there have been few female physicists.

As for future expectations regarding a career, women entertain more varied ideas for the future compared their male colleagues. Indeed the women often speak about the possibility of being involved in activities different from research and of having a family of their own. The leavers could be described as "intellectual emigrants" in as much as it emerges from their accounts that they often feel forced to go abroad because of the lack of career prospects in research in Italy.

REASONS FOR LEAVING PHYSICS

Introduction

The intention to leave physics, in the context of UPGEM's research countries, essentially means leaving a research career at university. There are two clearly defined categories of factors that cause physicists to leave their careers; the 'push' and the 'pull' factors. The 'push' factors are inherently negative aspects of working in the faculty of physics while the 'pull' factors are those inherently positive attributes that careers outside research offer physicists. Personal attitudes and different social contexts influence not only researchers' viewpoints of the 'push / pull' factors, but also the emphasis an individual places on each factor, if at all, to the extent that the 'push / pull' factors are not a commonality shared by the UPGEM research countries.

Furthermore, we have to consider that there could also be other 'push factors' which are not mentioned explicitly, but that still played a role in the choice to leave. The reported reasons given for leaving in this summary are the explicit reasons and explanations given by the physicists. The reasons for leaving, as reported in this summary, may be viewed as applicable to both sexes unless specifically stated.

Denmark

The shortage of appointments, short-term contracts and the opportunity to obtain permanent posts outside the university are among the most common

reasons for leaving in Denmark. Furthermore, the sense is that if a permanent appointment at university has not been gained by the age of 40/45 leaving is a better option otherwise it becomes very difficult to find a position outside the university context with the background exclusively of an academic researcher.

Pay, as a problem, is often mentioned as a secondary reason by leavers, especially by those with children, as a problem. The salaries of university contracts are not sufficient to keep a family.

Moreover, having a family with a career works better in jobs outside the university as well as outside research, in regards to time management and the size of salaries are concerned. Several factors connected to family responsibilities, position, pay and working hours are given as fundamental reasons for leaving. Maternity leave, especially for those on a short-term contract, is another factor which may induce women to abandon research.

Leaving work at university generally means, in the Danish context, leaving research altogether. The vast majority of leavers have found work in different, non-research based, sectors. As regards the leavers there are the contrasting happy and (by default) unhappy viewpoints of their new work. Most of the Danish leavers are 'happy leavers' and do not contemplate a return to research.

Finland

A key 'push' factor, in Finland, is the lack of career prospects due to the shortage of available permanent positions. Low salaries are also a reason for leaving; a physicist's salary can easily be doubled in a job in industry or business.

Motivational problems are also quoted linked to the fact that there are not always immediate answers in research work, which requires a farsighted outlook with respect to the applicability of results.

Other reasons can be an unpleasant atmosphere in the work-place, a competitive environment, insufficient supervision, poor organization of work and the lack of prestige. Even though these factors were mentioned by both sexes, it was more often the men who referred to the atmosphere in the work-place and competition.

Besides the 'push' factors there are other factors which 'pull' researchers to leaving the research sector. Family commitments, opportunities for

permanent positions and better salaries, better career prospects and more clearly defined tasks, are the pull factors most cited in Finland.

A fair number of leavers are considering the possibility of going back to do university research in the future and some maintain fairly regular contacts with the sector in which they carried out research. In this sense the Finnish university is often well-disposed, for example, to allowing part-time doctorate contracts.

Estonia

The current situation of the physics sector is the consequence of the political and economic changes in the 1990s that occurred after the regaining of independence from the Soviet Union. Politics and economics have major roles in creating the reasons for leaving research. Primarily Moscow cut the funds for scientific research, which created a shortage of jobs in the sector. Some physicists were forced to abandon research in circumstances similar to dismissal.

The funding cuts also led to significant reductions in salaries. At the same time rapid economic inflation made life difficult on a scientist's salary, especially when there was a family to provide for. Many physicists abandoned research for more remunerative sectors, such as business or politics, while women went mainly into the public sector.

In other instances, there was the opportunity to obtain new research contracts, but at a 75% or 50% weighting of a full workload contract depending on the available finances. This meant in reality that while the salary was reduced the workload remained the same. The lack of work opportunities in the scientific sector placed new graduates in the position of either leaving physics altogether or continuing abroad. Many decided on the latter course and went to foreign universities, but those who already had a family of their own returned home having gained their doctorate or post-doctorate qualification.

For returnees from abroad there was the problem of integration with those with whom they would have to continue to work. This resulted in a lack of role models for the young physicists and in the absence of any social ties between the returnees and the older generation. The problem of identity for the women was twofold, because other than the generation gap

they also had to cope with an evident gender gap in the sector where there was now a clear female minority.

The decision whether to stay or to leave, especially for the women, was also influenced by the presence of a mentor or a suitable supervisor.

Poland

The fall of Communism and the subsequent changes in the 1990s had a major influence on the reasons for leaving the physics sector in Poland. Three different groups emerge in the typologies of reasons for leaving, which reflect the stages of the country's recent history: the Communist period, the interim period of the 1990s and the beginning of the 21st Century.

During the Communist period, any idea of leaving was rather remote, because the career of a physicist at university was clearly outlined and predictable. In the rare cases of leaving, the men gave the reason of ideological issues linked to the political situation of that time and, for the women, personal issues such as bad relations with colleagues in the department, an unpleasant atmosphere at work or family commitments.

The economic instabilities and the financial crisis of the 1990s created the key conditions, significant reductions in university salaries and the rise of business sectors that drove the economy that led to the greatest number of physicists leaving physics research. Physicists were highly sought after and were recruited by banks, insurance and consultancy companies, where salaries were practically double those of the university. Leaving physics for financial reasons at the time was most pertinent to the men as familial breadwinners.

All factors that can be ascribed to the work environment influence the women's decisions to stay or leave, such as, unsatisfactory relations with one's supervisor, the impossibility to reconcile this type of work with the family. During this period many women left research in order to follow their husbands, who carried on with their careers. The travelling required by physics research created problems, especially for the women, in some cases forcing them to leave.

After 2000 there was a reversal of the exodus with physicists preferring to seek extra work to supplement their income to taking the decision to leave. The status of the university career has returned to the pre–1989

position; the low salaries are more than balanced by job security. The physicists who lose out in this situation are Ph.D. students who sometimes leave because of the scant availability of vacant positions.

Italy

In Italy a number of physicists have chosen to leave the country to take up similar research work under better conditions in France. Though, these physicists have not left the physics research sector, they are categorised as 'leavers' in the national report because a return to Italy is considered almost impossible. The main reason which causes physicists to leave research and/or the country is the lack of funding and its consequences.

Short-term contracts, described as the only type of contract which researchers can obtain, often until they are 40 years-old, provide modest salaries. Besides this, researchers must often wait several months before their contract is renewed or before they can sign a new one, and during that time they receive no remuneration, making it necessary for them to be maintained financially by a partner or by the family.

Another series of reasons for leaving is related to the work environment: bad relations between colleagues, systems of "barony", discrimination on the part of coordinators. Several leavers, of both sexes, said they did not like the strong competition which characterized the work environment, and the informal non-meritocratic practices typical of the university. The most important factor in order to stay and advance in a career is having the "right" professor, i.e. who has power in the faculty and who can in some way push you ahead. The importance also emerges for researchers to have dealings with a manager who is sincere in terms of the prospects available, so that researchers can in some way plan their professional future and decide whether to continue or to leave. In many cases, however, it is considered part of the game for researchers to work without knowing how much and in what way they will be paid, because they are expected to "rise through the ranks".

The decision to give priority to the family is also a major influence in the decision to leave research. Low salaries and heavy workloads make it difficult to reconcile this profession with the commitments of a family. In this sense the leavers underline the importance of having support from their parents in order to continue with this career, both to compensate for the low

salaries and to help in caring for the children, due to the fact that public social and childcare facilities are totally inadequate.

A career in teaching, especially in high school, is a common option for those who leave research. However, many leavers consider teaching in secondary education is only considered as a second best option, as the 'pull' factors are low in terms of motivation. Another possibility for leavers is to do research abroad, but many of them state that they do not like the idea of moving from one country to another for their career, as then it would be difficult to come back to do research in Italy. Many Italian researchers who work abroad live as "intellectual emigrants" who want to return to the homeland, but are well-aware that it is difficult to do so.

Summing up

The choice to abandon research is hardly ever possible to ascribe to one unequivocal reason. A complex of pre-existing causes and conditions create the environment that leads to 'brain-drain' in the various countries. However, some factors are trans-national in the different cultural contexts, whereas others are country specific.

The issue of research funding, and the consequences of funding cutbacks, is widespread. Above all, the size of salaries in research, often quite low in comparison to the high profile and high level of requisite qualifications, makes people look for a more remunerative job outside research. Moreover, physicists are highly sought after in different sectors, such as industry or business, where salaries can easily be doubled or tripled. Many physicists in Estonia have, for example, as a result of the socio-cultural transition changes of the 1990s, gone into politics. The current situation in Poland is interesting because the 'pull' factors of working outside the research sector are mitigated by job security in the universities.

Short-term contracts are often the norm in the research sector. The lack of any guarantee of stability makes planning for the future, especially families, difficult in the extreme. A further consequence of the funding issue, which is common to all five countries, is the shortage of available posts and the difficulty in career advancement.

In both Denmark and Italy, the issue emerged explicitly as an 'age' related problem. There comes an indefinable age range, at which prospective employers outside any sector consider applicants to be too old to retrain. The work environment provides a range of reasons to leave ranging from a highly competitive arena, to an unpleasant atmosphere resulting from difficult relations with colleagues or with a supervisor. The lack of meritocracy and barony are, in the context of UPGEM's research, specific characteristics of the Italian context.

While these factors emerge in the data of the different countries, they contribute to the choice to leave rather than being fundamental reasons for doing so.

The issue of work motivation emerging in the Finnish data is interesting: the fact of not seeing short-term or socially useful results in one's research work has a negative influence on the motivation to continue.

The difficulty of reconciling the career of a physicist with family commitments, in terms of time management, is another aspect of leaving in all the UPGEM countries. Other jobs outside this sector allow people to reconcile work and family with fewer sacrifices. Here, too, the mobility required by the work of the researcher is a problem.

The great socio-political changes of the 1990s following the fall of the Communist regime have created a common situation in Poland and Estonia, as in both countries they had an important part in the reasons for leaving. The consequent economic decline influenced funding for research, forcing many physicists to leave, besides which many new work sectors emerged, offering positions with better salaries. Another aspect common to both countries is that the economic issue was one of the main reasons for leaving in the 1990s, above all for men; for the women it is not a fundamental reason, even though it is mentioned.

Annex II: Table of the Three Scientific Culture Types: Hercules, Caretakers, Worker Bees

The Table below illustrates some of the salient elements in the three types of scientific cultures, i.e. Hercules, Caretakers and Worker Bees, in physics *as* culture.

On a number of parameters, the three ideal types can be placed on a scale illustrating the level of engagement in physics, the level of engagement in social surroundings and the degree of importance of gender in each of the scientific cultures.

	HERCULES	**CARETAKERS**	**WORKER BEES**
Work relation:	Physics is the only thing	Physics is everything but must be socially acceptable	Physics is not everything in their life
Workplace Identity:	Focus is on ego	Focus is on the group	Focus is on the task and family and friends
Competition	1-on-1 fights using all means available	Group *versus* group	Uninterested in competition
Power relations	Anti-authoritarian with hidden power games	The group requires young members work their way up	Formal hierarchy
Gender	Used as a negative element in competition	Acceptance of gender roles in relation to groups and not used negatively in competition	Not used negatively in competition

For a further description of each of the scientific cultures, see Hasse & Trentemøller (Eds.) (2008). *Break the Pattern! A critical enquiry into three scientific workplace cultures: Hercules, Caretakers and Worker Bees.* Tartu: Tartu University Press

Annex III: Table of Female Physics Ph.D.s

Table 12. Percent of physics PhDs awarded to women in selected countries: 2-year averages.

	% PhDs to women	Avg # of PhDs per year, both sexes
Turkey	28	50
France	26	898
Greece	25	39
Australia*	20	100
Latvia	20	3
Denmark	20	51
Norway	20	28
United Kingdom	18	415
Sweden	17	60
Slovenia	15	17
Poland	13	182
USA	13	1,237
The Netherlands	12	68
South Korea	10	125
Taiwan	10	24
Japan	10	374
Estonia	10	5
Germany	10	1,570
Switzerland	9	109
19 Countries	15	5,355

* Includes Master's degrees.

1998-99 data are presented for countires in blue. For all other countries, 1999-2000 data represented. To be included, countries had to provide approriate data from reliahle statistical agencies.

Compiled by AIP Statistical Research Center.

Annex IV: Survey Regarding Physicists in Academia

Doctoral/MSc. education

Please indicate your highest level of education:

☐Ph.D. ☐ Ph.D. student ☐ MSc. _____ ☐Other _____

1. At which university did you complete your doctoral or MSc. program?

University:	
Country:	

2. When was your doctorate or MSc. granted?

[ ] (yyyy)

3. From what field of physics did you obtain your doctoral or MSc. degree?

a. Astronomy and Cosmology ☐
b. Geophysics ☐
c. Nanophysics ☐
d. General Physics ☐
e. Biophysics ☐
f. Theoretical Physics ☐
g. Nuclear/Particle Physics ☐
h. Other field: _____ ☐

4. If doctor – please estimate the period between the date you commenced your doctoral program and the date your doctorate was granted?

[ ] (Round to whole months. Include time spent on preparing for exams required for and related to your doctoral degree and time spend on your dissertation)

5. In what country did you receive your previous university degree?

Country _____

6. Which of the following financial sources supported you during your doctoral or MSc. studies?

Mark (X) one Primary source of support in the first column and any Secondary source(s) of support in the second column

	Primary source of support	Secondary source(s) of support
a. Fellowship, scholarship from institution of enrolment	☐	☐
b. Fellowship, scholarship from another domestic institution	☐	☐
c. Fellowship, scholarship from institution abroad	☐	☐
d. Fellowship, scholarship from government	☐	☐
e. Fellowship, scholarship from government abroad	☐	☐
f. Fellowship, scholarship from EU	☐	☐
g. Fellowship, scholarship from domestic business	☐	☐
h. Fellowship, scholarship from business abroad	☐	☐
i. Fellowship, scholarship from a private non-profit org (PNP)	☐	☐
j. Fellowship, scholarship from another source abroad	☐	☐
k. Teaching assistantship at institution of enrolment	☐	☐
l. Teaching assistantship at another domestic institution	☐	☐
m. Research assistantship at your institution of enrolment	☐	☐
n. Research assistantship at another institution	☐	☐
o. Other occupation (full time)	☐	☐
p. Other occupation (part time)	☐	☐
q. Employer reimbursement/ assistance	☐	☐
r. Loan	☐	☐
s. Personal savings	☐	☐
t. Support from spouse's, partner's or family	☐	☐
u. Other – name source _____	☐	☐

Employment situation

7. Counting ALL jobs held on March 31, 2007, how many hours did you usually work during a week, including part-time, evening and weekend work?

☐ **of hours per week**

8. What was your position at the university on March 31, 2007?

☐ Research Assistant ☐ Assistant Professor ☐ Full Professor
☐ Post.doc ☐ Associate Professor ☐ Other: _____

9. What type of position are you presently employed in?

Mark (X) ONLY one	*Mark (X) ONLY one*	
☐ Permanent ☐ Temporary	☐ Full-time ☐ Part-time	☐ Several jobs

10. If the university job you held on March 31, 2007 was a part-time job. Were you searching for a full-time job?

☐ Yes, actively ☐ Yes, some ☐ No

11. What field of physics are you presently employed in?

a. Astronomy and Cosmology ☐
b. Geophysics ☐
c. Nanophysics ☐
d. General Physics ☐
e. Biophysics ☐
f. Theoretical Physics ☐
g. Nuclear/Particle Physics ☐
h. Other field: _____ ☐

12. What is the MINIMUM education level required for the job you held on March 31, 2007 at the university?

Mark (X) ONLY one

☐ Doctorate and some years of experience ☐ Doctorate
☐ Graduate with some years of experience
☐ Graduate ☐ Less than graduate

13. Please rate your satisfaction with your present job at the university.

Mark (X) ONLY one for each item

	Very satisfied	Somewhat satisfied	Fifty-fifty	Somewhat dissatisfied	Very dissatisfied
a. Salary	☐	☐	☐	☐	☐
b. Benefits	☐	☐	☐	☐	☐
c. Job security	☐	☐	☐	☐	☐
d. Job location	☐	☐	☐	☐	☐
e. Working conditions	☐	☐	☐	☐	☐
f. Opportunities for advancement	☐	☐	☐	☐	☐
g. Intellectual challenge	☐	☐	☐	☐	☐
h. Level of responsibility	☐	☐	☐	☐	☐
i. Degree of independence	☐	☐	☐	☐	☐
j. Support from colleagues	☐	☐	☐	☐	☐
k. Work/life balance	☐	☐	☐	☐	☐
l. Contribution to society	☐	☐	☐	☐	☐
m. Social status	☐	☐	☐	☐	☐

14. Have you considered leaving your present job within the last 6 months?

☐ Employment terminates ☐ Yes, very much ☐ Yes, some ☐ No

If “yes, very much” or “Yes, some”:

14.1 Please indicate (in each row) how important the following reasons are for your consideration?

Reason	Decisively important	Very important	Somewhat important	Slightly important	Not important
a. Want a more prestigious position					
b. Want more responsibility					
c. Want better pay					
d. Opportunities for advancement are lacking					
e. Lack of funding					
f. Want better working conditions					
g. Want better job security					
h. Demands of the job are too severe					
i. Hours required are too long					
j. Want a better Work Life Balance					
k. Want a higher degree of independence					
l. Look for more friendly working environment					

Other important reasons:

_____

15. Are you participating in networks related to your field of work?
Mark (X) Yes, intensely; Yes, a little or No for each item

	Yes, Intensely	*Yes, a little*	*No*
a. Network formed by friends/acquaintances/ colleagues at the university	☐	☐	☐
b. National network within the field but outside the university	☐	☐	☐
c. International networks within the field	☐	☐	☐
d. Participate in various (possible) linkage mechanisms (visits, training, joint projects, mentoring, fundraising)	☐	☐	☐

16. Do you plan to move to another country to work within the next couple of years?

☐ Yes, actively ☐ Yes, some ☐ No

17. If "yes" please, indicate the importance of the following reasons for your intension?

Reason	Decisively important	Very important	Somewhat important	Slightly important	Not important
a. End of post doc.					
b. End of job contract					
c. Sent abroad by employer					
d. Post doc. offer					
e. Other Job offer					
f. Better paid job					
g. Job search					
h. Guarantee or ease to find a job					
i. Better access to publishing					
j. Work in a specific area non existent in this country					
k. Possibility to create a new research area					
l. Family or personal reasons					
m. Political reason (incl. refugee)					
n. Economical reason					
o. End of residence permit / visa					

Other imprtant reasons: _____

Career related experiences

18. Are you performing the following tasks in your job at the university?

Mark (X) *Yes* + *% of time* or *No* for each item

	Yes	% of time	No
a. Research	☐	☐	☐
b. Teaching	☐	☐	☐
c. Administration	☐	☐	☐
d. Dissemination of knowledge in scientific journals	☐	☐	☐
e. Dissemination of knowledge to a broader audience	☐	☐	☐

19. Why did you choose a research career?

Mark (X) all that apply

☐ Creativity and innovativeness of work ☐ Well paid job ☐ Benefits
☐ Opportunities for advancement ☐ Job security ☐ Working conditions
☐ Degree of independence ☐ Contribution to society
☐ Other employment not available ☐ Support from mentor
☐ Tradition in the family ☐ Can balance work and family obligations
☐Other - Specify: _____

20. How long have you worked as a researcher since you graduated?

_____ (please state the total time in full years)

21. If you are or have been in <u>a permanent position as a researcher</u> please state how long it took you to obtain a permanent position as researcher after the completion of your doctoral degree?

☐ **Months**

Personal characteristics

22. Are you: ☐ male ☐ female

23. How old are you? ☐ years

24. Please state the name of the country in which you were born:

☐

25. What is your marital status?
☐ Married/cohabitant ☐ Single

26. If you are married/cohabitant. Is your spouse?
☐ Physicist ☐ Other natural scientist ☐ Neither

27. How many children/dependents do you have? Number
Number
5 years or younger ☐ 6 to 18 years ☐

28. Counting ALL jobs held, what were your GROSS ANNUAL EARNINGS for the year 2006?

☐ (in local currency)

All answers will be handled strictly confidential.

We would like, however to ask you to provide us with an e-mail address where you can be reached in case we need to clarify some of the information you have provided.

E-mail_____@_____

Annex V: The Proportion of Women in Different Physics Departments

Country	University	Department; Division Institute; Group	Men	Women	Women (%)
Poland	**Krakow**	Department of Geophysics	25	20	44
	Warsaw	Institute of Experimental Physics	107	48	31
		Institute of Theoretical Physics	77	14	15
		Institute of Geophysics	24	8	25
		Astronomical Observatory	22	3	12
		Mathematical Methods in Physics	21	2	9
	Poznan	Institute of Physics	161	71	31
		Institute of Acoustics	21	11	34
		Astronomical Observatory	14	8	36
	Lodz	Solid State Physics	25	4	14
		Experimental Physics	12	4	25
		Nuclear Physics and Radiation Safety	11	8	42
		Theoretical Physics	22	2	8
	Jagiellonian	Institute of Physics	190	42	18
		Astronomical Observatory	33	12	27
Estonia	**Tallinn**	Institute of physics	25	4	14
	National Institute of Chemical Physics and Biophysics	Group of High Energy and Computational Physics	7	1	13
		Teraherz and Low Temperature Group	6	1	14
		Liquid Phase Nuclear Magnetic Resonance Spectrometry	2	2	50
		Solid State Nuclear Resonance Spectrometry	9	0	0
		Mass-spectrometry and Catalysis	4	2	33
		Environmental Chemistry	4	4	50

Country	University	Department; Division Institute; Group	Men	Women	Women (%)
	Tartu	Faculty of Physics and Chemistry	80	11	12
		Institute of Physics	103	13	11
		Estonian Marine Institute	10	4	29
	Tartu Observatory	Department of Astrophysics	14	3	18
		Department of Cosmology	27	7	21
Finland	**Helsinki**	General physics	19	6	24
		Accelerator laboratory	26	4	13
		High energy physics	17	4	19
		Theoretical Physics	46	5	10
		X-ray Physics	14	6	30
		Atmospheric sciences	44	22	33
		Geophysics	11	7	39
		Astronomy	38	10	21
	Helsinki Institute of Physics	Theory program	36	5	12
		High energy physics program	9	2	18
		CMS-program	13	5	28
		Nuclear matter physics program	5	1	17
		Technology program	11	1	8
	Oulu	Biophysics	12	1	8
		space physics	18	3	14
		electron spectroscopy	9	4	31
		IR-spectroscopy	2	1	33
		NMR-spectroscopy	8	3	27
		Geophysics	5	3	38
		Theoretical physics	16	1	6
		Astronomy	12	7	37
	Jyväskylä	High energy physics	19	3	14
		Materials physics	47	9	16
		Nuclear and accelerator based physics	53	7	12

Country	University	Department; Division Institute; Group	Men	Women	Women (%)
Denmark	**NBI**	Astronomy	35	10	22
		Geophysics	39	13	25
		Nanophysics	46	7	13
		General Physics and Biophysics	114	23	17
	DTU	Theoretical Atomic-scale Physics	32	2	6
		Experimental surface and nano materials physics	14	6	30
		Quantum Physics and Information technology	16	2	11
		Biophysics and Complex Systems	17	2	11
	RUC	Physics; Physics Didactics	10	2	17
	Aarhus	Physics and Astronomy	157	24	13
Italy	**la Sapienza + INFN**	**Nuclear and particle physics**			
		CHORUS GROUP	4	3	43
		CHIMERA	11	6	35
		Alice Group	4	1	20
		AMS GROUP	8	4	33
		APE	5	1	17
		BABAR	7	1	13
		G23	34	8	19
		ZEUS	3	0	0
		TEONGRAV Gravitational Physics	2	2	50
		SUPERSTRIPES	4	2	33
		Astro physics			
		DAMA	3	2	40
		ANTARES GROUP	12	1	8
		ASTRO	7	0	0
		G31 Experimental Cosmology	10	4	29
		SCAE	5	7	58

Country	University	Department; Division Institute; Group	Men	Women	Women (%)
		Solid state physics			
		GLAS LIQUIDS AND AMORPHOUS SOLIDS	6	4	40
		GCI COMPUTATIONAL	5	3	38
		LOTUS	3	4	57
		Geophysics			
		Laboratorio di Fisica Terrestre - G 24	10	4	29
		Meteorology Group G-MET	1	2	67
		Theoretical physics			
		Ipparco: MATHEMATICAL PHYSICS	5	0	0
	INFN Rome	Nuclear and particle physics	46	13	22
	Naples	**Nuclear and particle physics**			
		ATLAS GROUP	17	3	15
		BABAR GROUP	10	1	9
		Fisica dei Nuclei e delle Radiazioni	34	7	17
		Theoretical physics	48	10	17
		Solid state physics			
		Acustica	1	1	50
		Geophysics	14	8	36
		Physics didactic	0	4	100
		Solid state physics			
		Condensed Matter Group	14	1	7
		Optics in Soft-Matter Group	9	1	10
		Brite Network LC Photonet	1	0	0
		INFM activities COHERENTIA	60	11	15
	INGV Rome	Geophysics	64	54	46

Research notes:
As mentioned in the section "UPGEM survey on women in physical science academia" the UPGEM head count registration differs from country to country and it has been quite a challenge to generate this list. Some universities list the information on department level, others at institute or group level. Please take the many limitations into consideration when analyzing the data in this Table. At Tartu University, for example, the information is listed on either division level or at group level and I have been going back and forth between the two. In some cases, the information is at both levels, which has forced me to choose one or the other. The 220 physicists (including 28 women) at Tartu University are for example listed in 26 different divisions or groups in the spreadsheet which does not provide a clear picture when converted to table format. At the University of Aarhus in Denmark there are also an extensive number of very small research groups in the department of physics and astronomy but no clear institute structure or group structure emerges from the listing in the UPGEM head count.

Annex VI: Notes on UPGEM Partners and Proceedings Contributors

UPGEM partners:

Cathrine Hasse is the co-ordinator of the EU-project UPGEM (Understanding Puzzles in the Gendered European Map) and holds a position as Associate Professor at the Danish School of Education (DPU), University of Aarhus.

As an anthropologist, she has for more than ten years studied physics education and research. She gained her Ph.D. at the University of Copenhagen on "cultural learning processes" in a physics institution. In her next project "The Cultural Dimensions of Science", she compared physics institutions in Denmark and Italy.

She has long participated in the Social Studies of Science network (4S), the network for cultural-historical research, ISCAR and has a long working relationship with Women in Physics in Denmark. She has been granted several projects by the Danish Research Council and has been awarded with a research scholarship at the Danish Institute for Human Studies and a six months grant to study at University of California, San Diego. She has been a keynote lecturer at, for example, NorWIP (Nordic Network for Women in Physics) and ESERA (European Science Education Research Association). She has been called as an 'expert' on women and science by the European Parliament and has been a member of the board of the Danish University of Education as well as the Society for Gender Research in Denmark.

Cathrine Hasse is the author of the book 'Kultur i bevægelse' [Culture In Motion] (2002) and many English articles on science, gender, culture and education.

Merja Helle, Lic.Soc.Sci, Researcher, is the legal representative of the Finish partner Yrjö Engeström, Centre for Activity Theory and Developmental Work Research, Helsinki. Since 2006, she has been employed by the University of Art and Design/IADE as head of research in the Mediaconcept Laboratory where they have developed the Change Labora-

tory method into a Mediaconcept Laboratory for media organizations and newsrooms. Merja Helle holds a Masters in Political science and Political history from the University of Helsinki in 1970 and a Lic.Soc.Sci (mass communication) from University of Tampere in 2004. Until 1995, she worked as a full time journalist, news editor etc. From 1995–1998 she was a doctoral student and part-time journalist, and from 1999–2004 was part-time researcher. In 2004–2005, she worked as a researcher in a project called Life as Learning funded by the Finnish Academy of Science. They researched an emerging new form of work – co-configuration. The research sites, where Merja Helle conducted the field work until the end of 2005, included a bank, a new health care centre and a high-tech company. Her research focused on developing strategic thinking and strategy implementation.

Her current research interests cover changing media concepts and journalistic work processes, media technology and transformation of journalistic identity, management of change and sustainability of change. Merja Helle has co-authored a number of articles in Finish and English, some of which include the "Back to the future. Using where-from and where-to tools to change work in the newsroom". *Adult Learning in the New Millennium-Conference* (2000); "From individual troubles to collective solutions – towards an intervention methodology of collective, expansive learning". In *1st Nordic-Baltic Conference on Activity Theory, Helsinki* (1997) and "Change laboratory as a tool for transforming work". *Lifelong Learning in Europe* (1996).

Kristina Rolin is a Lecturer of Philosophy at Helsinki School of Economics, Finland and project partner in the UPGEM-project .She received a Ph.D. in Philosophy from the University of Minnesota in 1996 and a Master of Social Sciences from the University of Helsinki, Department of Philosophy in 1990. She also has a five year research project (beginning August 1, 2004) called "Social Epistemology and Gender". Her expertise on (1) gender and physics and (2) social theory of knowledge is valuable for the UPGEM project for the following reasons. In her philosophical research, she has studied the question of what counts as empirical evidence for claims about gender in physics. In the case of physics, the challenge is to understand how gender ideologies can inform scientific practices in an

area of science where the subject matter of research is not directly related to gender issues. Another challenge is to understand how gender ideologies can become involved in knowledge-producing practices. Kristina Rolin's research on the social theory of knowledge provides a framework for understanding the social and cultural nature of knowledge-producing practices. Kristine Rolin has published numerous articles among others in journals like *Philosophy of Science*, *Social Epistemology*, *Perspectives on Science*, and *Hypatia*.

Endla Lõhkivi is an Associate Professor in philosophy of science at the Institute of Philosophy and Semiotics, University of Tartu, Estonia. She graduated at the Department of Chemistry of the above university in 1985. In 1999, she defended a *Filosofie Licentiat* thesis in theory of science at the University of Göteborg, Sweden, and in 2002 defended a Ph.D. in philosophy at the University of Tartu. Since 2004 she is the holder of the Chair in Philosophy of Science *ad interim* at the University of Tartu. Since October 2005 she is active in the EC 6th FP project UPGEM. Her research interests extend from general issues of philosophy of science to science and technology studies (STS). Before the UPGEM project she has carried out a case study on modelling practices in biochemistry. Also, she has been the principal investigator of the Estonian Science Foundation project "Constructivism in Philosophy of Science" 2004–2007, a senior researcher in the targeted funding project of the Estonian Ministry of Education and Research "Normativity: a critical study of its philosophical foundations, historical sources, and forms of manifestation" and currently she is a senior researcher in the targeted funding project "Critical analysis of relativism and pluralism regarding truth and knowledge, norms and values".

Anna Maria Ajello is full Professor at the Faculty of Psychology 2 at the University "Sapienza" of Rome. She is President of the Public Committee for the evaluation of projects founded by the European Social Fund and responsible for the qualitative evaluation process of the head teachers both in the Provincia Autonoma of Trento (It). She was Head of the Department of Development and Socialization Processes at the University "Sapienza" of Rome from 2003 until 2006 and member of the Public Committee for 'National guide for improving students' curriculum' of the Ministry of

Public Education in 2007. Prof. Ajello has acted as contractor in several European studies funded by the European Commission through the Leonardo Da Vinci and the Youth Programmes and as coordinator/ contractor in a number of studies funded by the Italian Ministry of Research and the Ministry of Public Education. She is also member of the board of the Ph.D. course "Interactional, communicational and socialization psychology" at the Department of Development and Socialization Processes, University of Rome "Sapienza".

Currently, Prof. Ajello teaches 'An introductory course to educational psychology' (Bachelor course), 'Training educational psychologists' (MA course), 'Modelling educational contexts' (Ma course) at the Faculty of Psychology 2 at the University Sapienza of Rome.

She has been interested in studying several themes in the field of Educational Psychology from a sociocultural pespective, such as: gender, competence, social sciences curricula, cognitive problems in knowledge acquisition at school and adults' curricula into organizational contexts.

She has authored and co-authored, edited and co-edited several books and reports, and published articles on the themes described above, e.g.: 'Che Genere di Tecnologie?' [Gender and Technology] in *Le tecnologie tra lavoro e apprendimento* [Technology at work and in everydaylife] (2008); 'Making non-formal and informal learning visible through digital portfolios', in *Trading Up: Potential and Performance in non-formal learning* (2005); 'Economy and knowledge acquisition: how to make easier, how to face obstacles', in *People's Understanding of Economic Issues in Europe* (2001).

Proceedings Contributors

UPGEM research assistants:

Lone Svinth, UPGEM Research Assistant, at the Danish University of Education, Denmark from 2005–2008. She has previously worked as Labour market consultant, Danish Commerce and Services, Denmark (1997–2002) and as Analyst, Economic research, at Unibank, Denmark (1995–1997).

Lone Svinth has a MSc. in Law and Economics from Copenhagen Business School, Denmark. As part of her education she spent a semester at the University of Washington, USA. Lone also holds a MA in Educational Psychology from The Danish University of Education, Denmark.

Her academic interests include social inclusion, flexible workplaces, life-work balance and labour market policies. In UPGEM she has primarily concentrated on literature search on why women leave science academia and on empirical comparative studies for a questionnaire survey on why men and women leave science academia.

Her key competences are quantitative methods and theories applied in dealing with the issue of why women leave science academia, labour market issues, social inclusion in workplaces and human resource management.

Agata Heymowski has been working as research assistant in the UPGEM project since 2007. She holds a MA in anthropology from University of Copenhagen (2007), and BA in culture science and anthropology from Silesia University in Poland (1995). She is also trained in project management at Warsaw School of Economics, Poland (2008).

In her Master's thesis, Agata Heymowski conducted an empirical study of 25 Danish companies in Poland, with focus on cultural differences and construction of the cultural self-evident meanings, and how these influence on Danish-Polish business relations.

Her research interests extend from the international construction of *cultural differences* and image of culture as an analytical object to international management and cultural processes in global organizations.

She has published an article in the Danish academic journal "Jordens Folk" [The People of the Earth] titled *Resten skal vi nok lære dem – om danske virksomheder i Polen.* In Jordens Folk, No. 1: *Frihed og usikkerhed.* Copenhagen 2005.

Conference speakers:

Lars Qvortrup is the new Dean of the Danish School of Education, University of Aarhus since January 1 2008. In 2007 he was Rector of the Royal School of Library and Information Science and from 2000 – 2007 he was Professor at the Department of Literature, Culture and Media, Centre for Media Studies, University of Southern Denmark. Lars Qvortrup has also been director of, or participant in, a large number of EU-projects and UN-projects, among others in Sri Lanka and Brazil. He has functioned as reviewer of research projects at the EU-Commission and at the research councils in Norway and Finland. He is a member of the International Advisory Board for the research ICT&S Centre in Salzburg. He is also a member of the editorial board of two international peer review journals: *Cybernetics & Human Knowing* and *Seminar.net.* Lars Qvortrup has initiated the foundation of interdisciplinary research centres aiming at research based development of the interplay between university, the corporate world and society in general.

Since 1977 he has either, or both, written and edited approximately 35 books in Danish or English and a high number of articles in Danish and international readers/journals (since 1983: 220 publications). He is well-known for his analyses of the knowledge society, cf. books such as *Det hyperkomplekse samfund* [The Hyper Complex Society] (1998), *Det lærende samfund* [The Learning Society](2001) and *Det vidende samfund* [The Knowing Society] (2004).

Nina Smith, M.Sc. (Econ), is Vice-Rector for academic affairs at the University of Aarhus. She is a prominent, distinguished researcher and one of Denmark's leading professors of political economics.

Nina Smith has been professor of political economics at Aarhus School of Business, University of Aarhus, since 1993.

Throughout her career, she has combined a high level of research with a significant academic commitment to both political economics and the research policy debate. She is Chair of the Board of the Danish Councils for Independent Research (DCIR) and Vice-Chair of the Danish Research Coordination Committee (DRCC). Professor Smith has been a member of such bodies as the Danish Government's Social Commission, Research Commission, Welfare Commission and Globalisation Council. She is a member of the Boards of Nykredit, PFA Pension and NIRAS.

Nina Smith's research interests cover labour supply and taxation; family friendly policies and women's career, intergenerational mobility and educational attainment, integration of immigrants into the labour market, allocation of time within the household, women in top management and firm performance and education economics and research policy

In addition to numerous articles and contributions to anthologies she is co-author of the book Smith, N., P- J. Pedersen, S. Pedersen and M. L. Schultz-Nielsen (2003), *Fra mangel på arbejde til mangel på arbejdskraft* [From lack of work to lack of workforce], Rockwool Fondens Forskningsenhed, Spektrum.

Rossella Palomba is Professor and a famous socio-demographic sociologist who is known worldwide for her activism. She has helped to bring the issue of Women in Science in Italy and in other European countries back to light by publishing her book *Minerva's Daughter*.

Rossella Palomba is a social demographer, research director at the CNR, Institute for Population and Social Policies and head of Department on Population, Social Behaviour and Policies. She was responsible for drafting the chapter on statistics and indicators of the ETAN Report "Science Policies in the European Union- Promoting excellence through main-streaming gender equality". She prepared the first draft of the "REIST Dossier on Women and Science" and the text of "She Figures" booklet. She has written books and articles on the situation of women in the Italian research system. The most recent ones are Population, Family and Welfare, Oxford University Press (2 volumes), Figlie di Minerva Franco Angeli-Milano.

Imbi Tehver is Doctor Emeritus in Physics at the Institute of Physics at University of Tartu, Estonia. Imbi Tehver's research interests include theoretical spectroscopy of crystals/molecules; theory of secondary radiation, coherent and spontaneous Raman scattering and hot luminescence; relaxation and energy transfer of electronic excitation.

Pia Thorngren Engblom is Docent in Nuclear Physics at Uppsala University and Guest Researcher at the Centre for Gender Research, currently also Project Leader for an investigation of recruitment processes at Uppsala University. She achieved her Ph.D. in Nuclear Physics in 1997 from Stockholm University. Her area of research is experimental nuclear physics, in particular in the field of hadron physics; that is the study of strongly interacting particles. She has been a spokesperson of an experiment at CELSIUS, Uppsala, Sweden and a post doc at IUCF in Bloomington, Indiana, USA. She continued this collaboration as senior member of the PINTEX collaboration. As a member of the PAX collaboration she is involved in polarization experiments at COSY in preparation for future activities at the Facility for Antiproton and Ion Research (FAIR) at GSI in Darmstadt. The main objective is to understand the spin of the proton.

Pia Thorngren Engblom has been a member of the Swedish representative at the European Few-Body Research Committee and is currently a member of the IUPAP C12 Nuclear Physics Commission. Through her association with the Centre for Gender Research at Uppsala University Pia Thorngren Engblom is committed to identify the nexus between Science, Gender, Region and Culture and is involved in a project which aim is to investigate how gender is created within a physics research enterprise that neglects the social realities of its pursuit and claim that objectivity and rationality are its only influences. Due to her interests, Pia Thorngren Engblom is a member of several networks concerning women in physics including the Nordic network of Women in Physics (NorWiP).

Pia has written several scientific articles published in various international journals.

Anja C. Andersen is Associate professor at the Dark Cosmology Centre, University of Copenhagen and Chair of Network for Women in Physics (NorWiP), Denmark. Her main research is on the role of cosmic dust on the

thermal, dynamical and chemical conditions in different astrophysical environments. Through her career she has been dedicated to convey the complexity of astronomy to the public in a comprehensible and alternative way. For that she was awarded the 'Rosenkjærprisen' in 2006 for outstanding public outreach. Among other awards, Anja C. Andersen has also received 'The Kirstine Meyer's Award' for outstanding research and The Descartes Prize for Science Communication for outstanding excellence in Science Communication.

Anja C. Andersen is a member of several learned societies including 'The Danish Academy of Technical Sciences', 'The International Astronomical Union', 'The European Astronomical Society' and 'Foreningen for kønsforskning i Danmark'. Anja C. Andersen is also a member of numerous networks which concern women in physics and she serves a number of committees, boards and panels concerning science, physics and the communication of these. Her long list of publications includes a wide range of national and international scientific articles and papers, papers on gender and research politics, and several books including '*Stjernestøv og Galakser – Himlen set fra Jorden*' [Star Dust and Galaxies – The Sky Seen from Earth], '*Stjernestunder*' [Star Moments] and a children's book called '*Pigen der ville give sin mor en stjerne*' [The girl who wanted to give her mother a star].

Jonas Dahl (MA and Head of section) is member of the Danish Parliament for The Socialist People's (SF) Party. He is the Socialist People's Party's candidate in Århus South nomination district since 2007. Jonas Dahl is SF's political spokesperson for research and university. He has also been a member of the Science and Technology Committee since 2007, and deputy member of the Health Committee, the Transport Committee, the European Affairs Committee, the Defence Committee, and the Environment and Regional Planning Committee since 2007.

Additionally, he held a seat on the board of directors in the Central Jutland Region Council, January 2006 – December 2007 and in the board of governors of Århus Academy since 2006.

Jonas Dahl has studied at The Bush School, Seattle, Washington, USA from 1995–1996 and earned his Masters in 2007 at University of Aarhus.

Anne Kovalainen is Professor of entrepreneurship at Turku School of Economics, Finland. She has earlier held professorial posts at the Swedish School of Economics, Helsinki and in sociology at the Abo Academy University, Turku, both of which are in Finland. She has been visiting fellow at Stanford University (2004), and visiting fellow at London School of Economics and Political Science (LSE) (2000, 1996) and at University of Bradford (1993), in the UK. An economic sociologist by training, her research interests are on economic sociology, economic activities of entrepreneurship, paid employment and atypical work relations as well as gender studies and sociology of work. More generally both research methodology and social theory are among her interest areas. She has led and participated in several research projects on issues of economic change and restructuring, quasi-markets and entrepreneurship on public sector, women's employment and comparative studies. She is in charge of the Global Entrepreneurship Monitor project for Finland, and in charge of research projects for the Ministry of Labour on transfers between paid employment and self-employment, and for the Ministry of Trade and Industry on entrepreneurship policy study. She is presently leading the Finnish part in EU FP6 Strep project on Knowledge, Institution and Gender (KNOWING), where the interests are in STS and epistemic communities of universities, formation and changes in them, as well as comparisons between East and West. She is also in charge of the Finnish network in EU FP6 Network of Excellence on Citizenship in Knowledge Society (Cinefogo).

Professor Kovalainen has edited, authored and co-authored several articles, books and publications, most recent ones including a research method book by SAGE (2008). She has been chair of the national sociological association (the Westermarck Society) and Board member and treasurer of the European Sociological Association (ESA). Professor Kovalainen is presently member and vice-chair of the Research Council for Culture and Society at the Academy of Finland for a second three-year-period.

Lisbeth Dons Jensen, BA social anthropology, is a research assistant in the WOME-CORE project.

At the Copenhagen Institute for Futures Studies, Lisbeth Dons Jensen mainly works with the more comprehensive European research projects on gender and work life in European research communities. She is a skilled quantitative and qualitative researcher and has experiences with strategic research, market analyses and user surveys. In addition to gender issues, her research interests also cover sexuality, women and career and consumer spending.

Lisbeth Dons Jensen is currently associated with WOMEN-CORE (Women in Construction Research) (2006–2008) and working with Meta-Analysis of Gender and Science Research (2008–2010).

Jens Rostrup-Nielsen is member of the Board of the European Research Council and former Director of the R&D Division and Member of Executive Board at Haldor Topsoe A/S. Jens Rostrup-Nielsen plays a prominent role in the public debate on research and education and due to his high level of expertise he holds a number of positions of trust. Rostrup-Nielsen has also been asked to join the European Research Council.

Jens Rostrup-Nielsen has been rewarded with honours and awards for his excellent work. He was awarded the Maxted Award on Catalyst Deactivation, Lexington, Kentucky (2001), Gold Medal of the Danish Technical University (2001), the Award of the Forum for Danish University Policy (2000), the Award for Excellence in Natural Gas Conversion (1998) and the Gold Medal of Julius Thomsen (1980). Moreover he became Knight of Dannebrog in 1992.

Jens Rostrup-Nielsen holds a long list of publications which numbers approximately 125 articles in refereed publications and 12 research policy articles.