GenPORT

Your gateway to Gender and Science resources

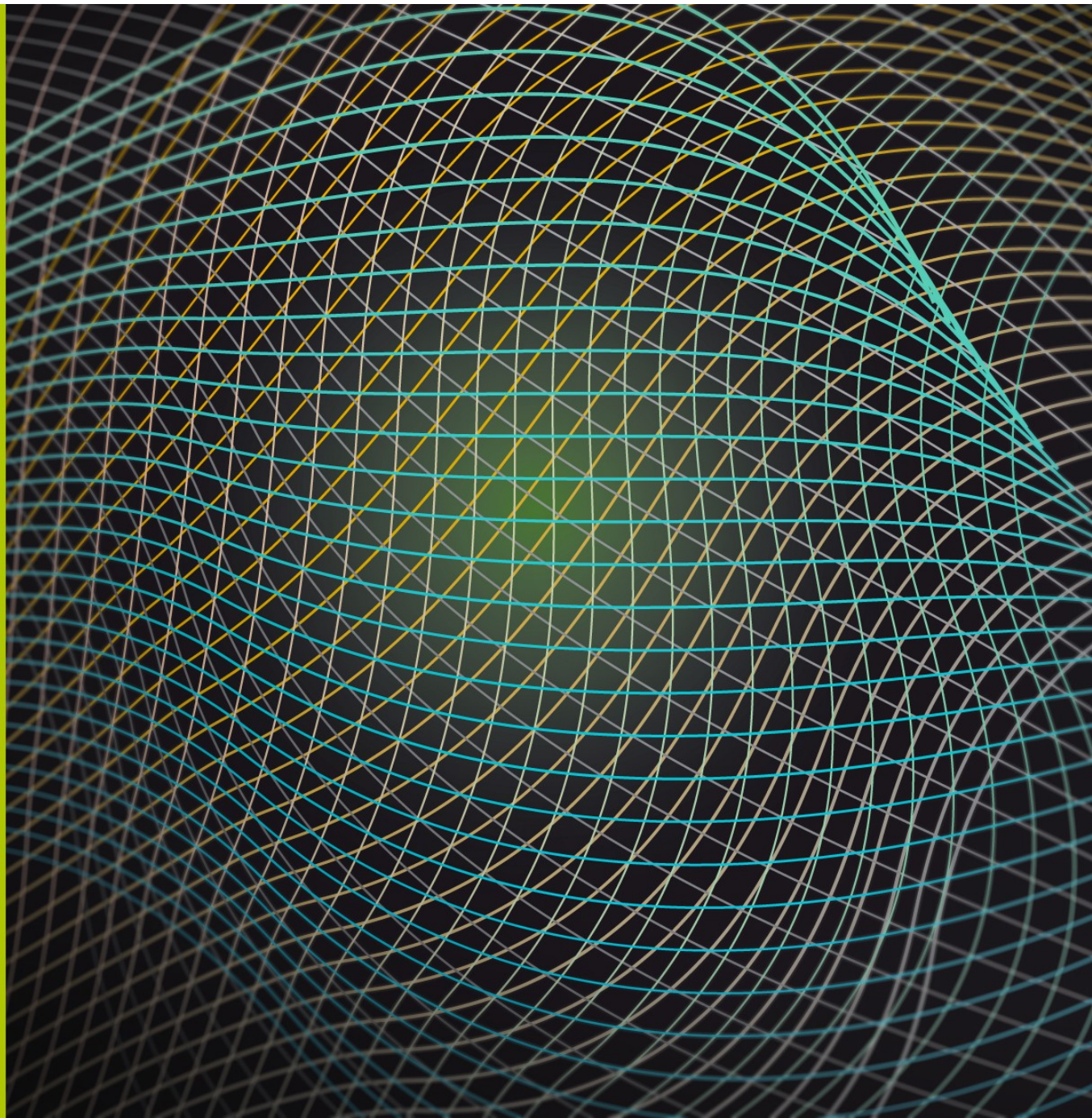
Research Synthesis 2

Academic and Science Careers

Authors

Jörg Müller and Rachel Palmén in collaboration with the GenPORT Consortium

V1.0 – September 2015



Description of the Problem

Women continue to be under-represented at the top of academic hierarchy. The ratio of women to men falls the higher up the career ladder, which has been explained by various metaphors including the 'leaky pipeline', the 'glass ceiling', the 'sticky floor' or represented as an open scissors diagram (GenSET, 2011). In 2010 in Europe, the proportion of female students (55%) and graduates (59%) exceeded that of male students, but women represented only 44% of grade C academic staff, 37% of grade B academic staff and 20% of grade A academic staff (EC, 2013:6). The percentage of women on the top rungs of the academic career ladder is not growing at the same rate as the number of women with the age and qualifications to reach these levels.

It is widely agreed that women's preferences for different subjects cannot explain this phenomenon. A statistical analysis of career trajectories has proved that the higher up the career ladder – the number of women is smaller – regardless of discipline. Greater pipeline leakage occurs in the fields in which women are already very prevalent (psychology, life sciences and social sciences), compared with the maths intensive fields in which they are under-represented (Ceci et al., 2014).

There are many explanations for gendered differences in scientific career trajectories, but two main approaches stand out. The first is related to the structure of the scientific career and its modelling on the male 'norm', whilst the second relates to a lack of support and gender bias – that may or may not be unconscious. These two factors – although at play throughout the entire academic career – impact differently when they intersect with key points throughout the life-course.

Gendered differences in career outcomes in science have been partially explained by the 'Matthew Effect' of cumulative advantage which operates throughout the life-course. It explains how slight advantages in capacity, structural location and available resources experienced at the onset of a career, accumulate and result in increased opportunities for carrying out research, thereby positively impacting on career outcomes (Merton, 1968; Merton, 1988). The 'Matilda Effect' uses the same logic to explain how gender discrimination results in cumulative disadvantage – where small disadvantages experienced since early career stages can impact negatively on female scientists' career outcomes (Rositter, 1993).

Recent and New Insights from Research

‘Ideal’ Faculty Member and Career Trajectory Based on Male Norms

The scientific career continues to be based on an outdated male model – despite fundamental societal changes including increased female participation in the labour market (NAS, 2007). The academic career model which consists of completing a series of sequential stages within a specified timeframe – discriminates against those who take time out – this particularly affects women who are more likely to request periods of leave for caring responsibilities. Key transition points throughout the career trajectory have been identified (from PhD to Post-doc to Independent Researcher to Professor) – when women are more likely to either drop-out, are pushed out or are not promoted (NAS, 2007; ESF, 2009). Whilst there are many career paths to excellence – the traditional route (modelled on the male norm) of early success and steady progress continues to be the most rewarded (Vinkenburg, 2014).

Work-life tension is particularly acute during the ‘rush-hour’ when the pressure on junior researchers to secure tenure track coincides with pressure to form a family. The ‘rush hour’ consists of multiple professional demands to: obtain a doctorate, carry out research abroad, secure a post-doctoral position and engage in intense competition for a tenure track position (ESF, 2009). Achieving an independent research post is a major critical point that is a clear determinant of career advancement. The average age for reaching this stage varies according to national and disciplinary contexts – but it tends to be between 25 and 35 years old. This disadvantages women as it not only coincides with the biological clock i.e. prime childbearing age – but women still tend to be responsible for caregiving and domestic responsibilities (Caprile et al., 2012; Schiebinger & Gilmartin, 2010). Research has also compared crucial stages of scientific (biology) and medical (doctor) careers, where in the case of the latter, the critical career stage is entry into higher education i.e. before family formation, whereas for the former, competition is more intense during the search for faculty positions which coincides with family formation (Adamo, 2013). However, results of the study found that job security is the greatest factor in explaining increased retention of women in medicine in comparison with science (ibid). Geographic mobility is especially important in the quest for tenure track – single women without dependents are as mobile as men yet at the doctoral/ post-doc stage women tend to become less mobile due to differential gendered effects of young children and partnering (Xie & Shauman, 2003). Time and mobility constraints

may be relevant in explaining slight differences in scientific performance at the early stages of a career – which become magnified by subsequent opportunities/lack of opportunities for doing research, thereby impacting decisively on career outcomes.

Recent research highlights the generational effects at play: people's attitudes are changing while institutions are not (Van Engen et al., 2012; Pedulla & Thebaud, 2015). Young male academics are more likely to have a professional partner and be more committed to taking part in domestic labour and childcare (Damaske et al., 2014; Hill et al., 2014). There is an emerging strand of research that charts these new and changing attitudes about science and careers – as young researchers both male and female strive for a more balanced life (Hammermann et al., 2015). The 'ideal' scientist model based on 100% dedication with a clear demarcation between work and family is not only divisive between men and women, but also creates divisions between men who fit this 'ideal' and those younger men with different aspirations. Research has charted how both academic men and women engage in resistance to the outdated notion of the 'ideal' scientist – by intentionally highlighting their own commitment to the academic career and family (Colbeck & Drago, 2005; Ollilainen & Richards Solomon, 2014).

Work-life balance issues may explain why some women and also some men drop out of science, but it does not fully explain why those women who stay do not advance. There is also no clear evidence that women without children have better career prospects, or that they succeed in catching up with men in their careers. Xie & Shauman (2003) demonstrate that researchers' productivity reflects their position in the academic hierarchy and the resources that are made available to them as a result of that position. Their research shows how, if academic track, academic position, type of institution and available resources are constant, men and women scientists publish at the same rate – whilst family status, marriage or parenthood have no impact on productivity. Research suggests that

"Research has charted how both academic men and women engage in resistance to the outdated notion of the 'ideal' scientist – by intent-ionally highlighting their own commitment to the academic career and family"

women academics experience different treatment in the workplace and are subject to discriminatory structures (Machado-Taylor & White, 2014).

Lack of Support and Gender Bias

Gender discrimination can be seen to operate on two distinct but inter-related levels. The first level is the lack of informal support for career advancement which can lead to discouragement. This can take various forms, including exclusion from social occasions to hostile working conditions and sexual harassment. The second level is concerned with bias in formal assessment procedures – which can impact on access to positions and funding.

In an attempt to understand vertical segregation in scientific careers, attention has been drawn to women's isolation and lack of supportive network ties (Dyer & Montelone, 2007; Etzkowitz & Kemelgor, 2001; Belle et al., 2014; Abramo et al., 2013). Informal networks have been shown to be crucial for career development in science – they serve various functions including fostering a sense of belonging in the scientific community, providing access to professional resources, and opportunities for advancement and encouragement. Research has shown how women tend to have less social support than their male colleagues, which negatively impacts on their ability to obtain the necessary resources for a successful career (Bagihole & Goode, 2001).

Research has also shown how gender discrimination both overt and covert takes place – in academia the latter may take the form of 'non-occurrences' – which are particularly difficult to challenge (Husu, 2001). Qualitative research has documented these, with authors noting the difficulties of generalising individual experiences to female experiences – thereby resulting in a lack of recognition of this issue (Koski & Tedre, 2003). Women adopt coping strategies and strategies of resistance to challenge this covert discrimination (Husu, 2001). An unsupportive working environment has also been identified in explaining why women may be less inclined to apply for funding or promotion (Fox & Xiao, 2013; White Berheide & Walzer, 2014).

Research in the US has shown how a good mentoring relationship can have a positive impact on retention, productivity, professional satisfaction and career advancement (NAS, 2009). These outcomes are specifically relevant for women and ethnic minorities – whilst outcomes for men are negligible. This shows how formal

mentoring programmes can provide the much needed support that men may often find in their informal networks. Mentoring has been identified as particularly important at the PhD and post-doctoral phase – when junior researchers are at a critical stage of their career trajectory (ESF, 2009). A lack of mentoring has also been identified as decreasing the likelihood of women applying for full professorships (White Berheide & Walzer, 2014).

The work climate in academic environments, as in other male-dominated work environments, has been identified as sometimes hostile for women. This can manifest in different ways – including exclusion from social activities, bullying and sexual harassment (Bagihole & White, 2013). Sexual harassment may take various forms including serious harassment or the exaggeration of sexual roles (Mankkinen, 1995). One poll in the United States conducted by the Washington Post says that one in five women have been sexuality assaulted at college. It could be one incident or occur more frequently, but crucially it is under-reported. The effects of sexual harassment are therefore underestimated in assessments of female researchers' career trajectories.

The allocation of tasks, research, administration and teaching – specifically in mid-career – has been used to explain gendered outcomes in career trajectories of researchers (Ledin et al., 2007). Tasks are valued differently: research tends to be highly valued due to the impact of publications on career development; administration and teaching, although time consuming, are devalued for promotion (Awando et al., 2014). Studies have shown how women at the mid-level disproportionately engage in teaching and administration, whilst men are more likely to engage in research (Izquierdo et al., 2004). The general view is that gender differences in the allocation of time to research, teaching and administrative tasks have important consequences for career advancement – especially for senior positions (Caprile et al., 2012).

"An unsupportive working environment has also been identified in explaining why women may be less inclined to apply for funding or promotion"

The assessment of excellence shapes the scientists' career trajectory at different stages, through selection, recruitment and promotion, whilst also playing a crucial

role in peer review (Moss-Racusin et al., 2012; Reuben et al., 2014; Sheltzer & Smith, 2014; Wennerås & Wold, 1997). Whilst the assessment of excellence is an integral part of a scientists' job, until recently 'excellence' itself was not subject to scrutiny. Excellence was perceived as 'objective', i.e. beyond context and culture, but recent research has highlighted the subjective nature of its assessment and has demonstrated how unconscious bias impacts on the formal assessment of excellence, negatively affecting women's career advancement (Reuben et al., 2014). Research has also shown that in comparison to male senior faculty, women faculty with equal accomplishments are less likely to be in receipt of similar levels of resources: salaries, laboratory space, grants, awards and other forms of support (Hopkins et al., 2002; Bedi et al., 2012).

The higher we climb up the academic ladder, we can see more pervasive effects of the 'old boys' network which combine with above described mechanisms. Research has highlighted how the low female presence at the highest levels of the scientific hierarchy points to the incapacity of research institutions to keep up with societal changes. This brings to light the contradictions of a dysfunctional system that, despite undertaking the critical role of assessing excellence, has not weakened the 'old boys' network system of co-optation. This means that key decisions regarding promotion are taken on the basis of who forms part of the 'club' – and not on merit (Palomba, 2006). This highlights the importance of a push for greater transparency in human resource decision-making in research institutions – and how this may impact positively on diminishing the bias of an academic system that systematically hinders women from fulfilling their potential and reaching top positions in academia.

Implications for Policy

There are a raft of policies which aim at promoting women's careers through career and skills training, stipends and scholarships, networking and mentoring, and measures for work-life balance. Evaluations of these policies have shown how they are highly beneficial at the individual level, but their impact on the structural level remains to be fully explored (Castaño et al., 2010). This calls for an approach which examines the relationship between the individual benefit from these type of policies and institutional change. There is also a clear need to re-think the outdated linear model of science careers and not penalise those researchers that do not fit into this model.

In Europe and the US, there has been a push for institutional change which attempts, amongst other things, to make decision-making more transparent and remove unconscious bias from institutional practices in research institutions. This is a much welcomed approach.

In the US, this type of work has begun as a result of institutional change initiatives funded through the ADVANCE programme. In Europe, work on institutional change is just beginning to bear fruit as a raft of structural change projects funded by the European Commission begin to publish their results (INTEGER; FESTA; Genis-Lab; STAGES; TRIGGER; Gender-net-ERA), in parallel with a range of national level actions (for example, Athena Swan in the UK). It is hoped that these institutional change initiatives will impact substantially on gender equality in research and innovation.

Bibliography

Abramo, G., DiAngelo, C. & Murgia, G. (2013). Gender differences in research collaboration, Journal of Informetrics, Vol. 7, pp. 811–822.

Adamo, S. (2013). Attrition of Women in the Biological Sciences: Workload, Motherhood, and Other Explanations Revisited, Bioscience, Vol. 63, No. 1, pp. 43-48.

Austin, A. E. & Laursen, S. L. (2014). Institutional Portfolio: Virginia Tech, in Laursen, S. L., & Austin, A. E., StratEGIC Toolkit: Strategies for Effecting Gender Equity and Institutional Change, Boulder, CO, and East Lansing, MI.

Awando, M., Wood, A., Camargo, E. & Layne, P. (2014). Advancement of Mid-Career Faculty Members: Perceptions, Experiences and Challenges, in (eds.) V. Demos, C. White Berheide & M. Texler Segel, Gender Transformation in the Academy, Advances in Gender Research, Vol. 19, Bingley, Emerald Group Publishing Limited.

Bagihole, B. & Goode, J. (2001). The Contradiction of the Myth of Individual Merit, and the Reality of a Patriarchal Support System in Academic Careers: A Feminist Investigation, European Journal of Women Studies, Vol. 8, No. 2, pp. 161-180.

Bagihole, B. & White, K. (2013). Generation and Gender in Academia, Basingstoke, Palgrave Macmillan.

Bedi, G., Van Dam, N. & Munafo, M. (2012). Gender inequality in awarded research grants, The Lancet, Vol. 380, pp. 1967-2052.

Belle, D., Smith-Doer, L. & O'Brien, L. (2014). Gendered Networks: Professional Connections of Science and Engineering Faculty, in (eds.) V. Demos, C. White Berheide & M. Texler Segel, Gender Transformation in the Academy, Advances in Gender Research, Vol. 19, Bingley, Emerald Group Publishing Limited.

Caprile, M. et al. (2012). Meta-analysis of gender and science research, Brussels, European Commission.

Castaño, C., Müller, J., Gonzalez, A. & Palmén, R. (2010). Policy Towards Gender Equity Towards Science and Research – Meta-Analysis of Gender and Science Topic Report.

Ceci, S. J. et al. (2014). Women in Academic Science: A Changing Landscape, Psychological Science in the Public Interest, Vol. 15, No. 3, pp. 75–141.

Colbeck, C. & Drago, R. (2005). Accept, Avoid, Resist: How faculty members respond to bias against caregiving… and how departments can help, Change 37, pp. 10-17.

Damaske, S. et al. (2014). Male Scientists' Competing Devotions to Work and Family: Changing Norms in a Male-Dominated Profession, Work and occupations, Vol. 41, No. 4, pp. 477–507.

Dyer, R. A. & Montelone, B. A. (2007). An institutional approach to establishing professional connections, in (eds.) A. J. Stewart, F. J. Malley, & D. La Vaque-Many, Transforming Science and Engineering: Advancing Academic Women, pp. 48-61, Ann Arbor, University of Michigan Press.

Etzkowitz, H. & Kemelgor, C. (2001). Gender Inequality in Science: A Universal Condition?, Minerva, Vol. 32, No. 2, pp. 239-257.

European Commission (EC) (2013). She Figures 2012: Gender in Research and Innovation, Luxembourg, Publications Office for the European Union.

European Science Foundation (ESF) (2009). Research Careers in Europe. Landscape and Horizons, Strasbourg, IREG.

Fox, M. & Xiao, W. (2013). Perceived Chances for Promotion among Women Associate Professors in Computing: Individual, Departmental and Entrepreneurial Factors, Journal of Technology Transfer, Vol. 38, No. 2, pp. 135-152.

GenSET (2011). Advancing RTD through Gender-Fair Recruitment and Retention Strategies, genSET Workshop Briefing Materials.

Hammermann, A., Schmidt, J. & Stettes, O. (2015). Beschäftigte zwischen Karriereambitionen und Familienorientierung – Eine empirische Analyse auf Basis der BIBB/BAuA-Erwerbstätigenbefragung 2012, IW-Trends, Vierteljahresschrift zur empirischen Wirtschaftsforschung, Vol. 42, No. 1.

Hill, P. W., Holmes, M. A. & McQuillan, J. (2014). The New STEM Faculty Profile: Balancing Family and Dual Careers, in (eds.) V. Demos, C. W. Berheide, & M. T. Segal, Gender Transformation in the Academy, pp. 3–20, Bingley, Emerald Group Publishing Limited.

Hopkins, N. et al. (2002). The Status of Women Faculty at MIT: An Overview of Reports from the Schools of Architecture and Planning, Engineering and Humanities, Arts, and Social Sciences and the Sloan School of Management.

Husu, L. (2001). Sexism, Support and Survival in Academia. Academic Women and Hidden Discrimination in Finland, Social Psychological Studies 6, Department of Social Psychology, Helsinki, University of Helsinki.

Izquierdo, M, Mora, E., Duarte, L & León, F. (2004). El sexisme a la UAB: propostes d'actuació i guia per a un diagnòstic, Universitat Autònoma de Barcelona, Bellaterra, Servei de publicacions.

Koski, L. & Tedre, S. (2003). Sukupuolipiiloja ja - huolia. Naisten muistoja yliopistouralta' Naistutkimus, Vol 3, pp. 19-32.

Ledin, A., Bornmann, L., Gannon, F. & Wallon, G. (2007). A persistent problem. Traditional gender roles hold back female scientists, EMBO Reports, Vol. 8, No. 11.

Machado-Taylor, M. & White, K. (2014). Women in Academic Leadership, in (eds.) V. Demos, C. White Berheide & M. Texler Segel, Gender Transformation in the Academy, Advances in Gender Research, Vol. 19, Bingley, Emerald Group Publishing Limited.

Mankkinen, T. (1995). Akateemista nuorallatanssia. Sukupuolinen ahdistelu härintä Helsingin yliopistossa, Tasa-arvotoimikunta, Helsinki.

Merton, R. (1968). The Matthew Effect in Science, Science, Vol. 159, No. 3810, pp. 56-63.

Merton, R. (1988). The Sociology of Science. Theoretical and Empirical Investigations, Chicago and London, The University of Chicago Press.

Moss-Racusin, C., Dovidio, J., Brescoll, V., Graham, M. & Handelsman, J. (2012). Science faculty's subtle gender biases favor male students. Proceedings of the National Academy of Sciences of the United States of America, Vol. 109, No. 41, pp.16474–9.

National Academy of Science (NAS) (2007). Beyond Bias and Barriers. Fulfilling the Potential of Women in Academic Science and Engineering, Washington DC, The National Academy Press.

National Academy of Sciences (NAS) (2009). Gender Differences as Critical Transitions in the Careers of Science, Engineering and Mathematics Faculty, Washington DC, The National Academies Press.

Ollilainen, M. & Richards Solomon, C. (2014). Carving a "Third Path": Faculty Parents' Resistance to the Ideal Academic Worker Norm, in (eds.) V. Demos, C. White Berheide & M. Texler Segel, Gender Transformation in the Academy, Advances in Gender Research, Vol. 19, Bingley, Emerald Group Publishing Limited.

Palomba, R. (2006). Does Gender Matter in Scientific Leadership?, OECD Women in Scientific Research: Unleashing the Potential, pp. 133-138, Paris, OECD publications.

Pedulla, D. S. & Thebaud, S. (2015). Can We Finish the Revolution? Gender, Work-Family Ideals, and Institutional Constraint, American Sociological Review, Vol. 80, No. 1, pp. 116–139.

Reuben, E., Sapienza, P. & Zingales, L. (2014). How stereotypes impair women's careers in science, Proceedings of the National Academy of Sciences of the United States of America, Vol. 111, No. 12, pp. 4403–8.

Rositter, M. (1993). The Matilda Effect in Science, Social Studies of Science, Vol. 23, pp. 325-341.

Schiebinger, L. & Gilmartin, S. (2010). Housework Is an Academic Issue: How to keep talented women scientists in the lab, where they belong, Academe, Vol. 96, No. 1, pp. 39-44.

Sheltzer, J. M. & Smith, J. C. (2014). Elite male faculty in the life sciences employ fewer women, Proceedings of the National Academy of Sciences of the United States of America, Vol. 111, No. 28, pp. 10107–10112.

Van Engen, M. L., Vinkenburg, C. J. & Dikkers, J. S. E. (2012). Sustainability in Combining Career and Care: Challenging Normative Beliefs about Parenting, Journal of Social Issues, Vol. 68, No. 4, pp. 645–664.

Vinkenburg, C. (2014). Capturing Gendered Career Paths of ERC Grantees and Applicants, Plenary Session 3: Maximising Capacity of Science Human Capital and Knowledge Communities, European Gender Summit, 2014.

Wennerås, C. & Wold, A. (1997). Nepotism and Sexism in Peer Review, Nature, Vol. 387, pp. 341-343.

White, Berheide, C. & Walzer, S. (2014). Processes and Pathways: Exploring Promotion to Full Professor at Two Liberal Arts Colleges in the United States, in (eds.) V. Demos, C. White Berheide & M. Texler Segel, Gender Transformation in the Academy, Advances in Gender Research, Vol. 19, Bingley, Emerald Group Publishing Limited.

Xie, Y. & Shauman, K. (2003). Women in Science: Career Processes and Outcomes, Cambridge, M.A, Harvard University Press.

Note: The present document gives a brief overview of recent research findings regarding *Academic and Science Careers*. Further research syntheses on (1) Education and Training, (3) Institutional Practices and Processes, (4) Gender in Research Content and Knowledge Production, (5) Policy Setting and Implementation, and (6) Historical Perspectives and Future Scenarios are available at www.genderportal.eu

An **up to date version** of the bibliography and further relevant resources can be found under the following address:

http://www.genderportal.eu/tags/research-synthesis-2-academic-and-science-careers

GenPORT is funded by the European Union FP7-SCIENCE-IN-SOCIETY-2012-1 programme grant agreement nº 321485. Information given in this document reflects only the author's views. The European Community is not liable for any use that might be made of the information contained therein.