

Career development and motivation analyses of female and male applicants to the EMBO Long-Term-Fellowship Programme

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Abstract Deutsch

Ausgehend von der Beobachtung, dass Antragstellerinnen beim Long-Term Fellowship (LTF) Programm der European Molecular Biology Organization (EMBO) durchweg niedrigere Annahmquoten aufgewiesen haben als Antragsteller, haben wir in dieser Studie den Einfluss des Geschlechts auf den Auswahlprozess und die Karriereverläufe der Antragstellenden untersucht. Die Auswertung des Publikationsoutput der Personen, die im Jahr 1998 einen Antrag eingereicht haben, zeigt, dass Frauen weniger publizieren als Männer. Dies haben wir als einen wichtigen Grund für die unterschiedlichen Annahmquoten identifiziert. Um die Gründe für die Unterschiede im Publikationsoutput zu identifizieren, haben wir den Antragstellenden des Jahres 1998 acht Jahre nach der Antragstellung einen Fragebogen zum Karriereverlauf, zur privaten Lebenssituation und zu Handlungsmotiven (z. B. für Ortswechsel) zugeschickt. Die Ergebnisse deuten darauf hin, dass der niedrigere Publikationsoutput (und damit die geringeren Annahmquoten) der Frauen teilweise damit erklärt werden kann, dass Frauen häufiger als Männer ihre Karrieren an die des Partners anpassen: (1) Sie haben häufiger einen promovierten Partner (62% gegenüber 44%). (2) Ein höherer Anteil an Personen unter den Frauen als unter den Männern führte wegen des Partners einen Ortswechsel durch (51% gegenüber 18%). (3) Frauen mit Kindern arbeiten weniger Stunden als Männer mit Kindern. (4) Die Mehrheit der Frauen mit Kindern, aber nur 19% der Männer mit Kindern hat einen Partner, der über 46 Stunden pro Woche arbeitet.

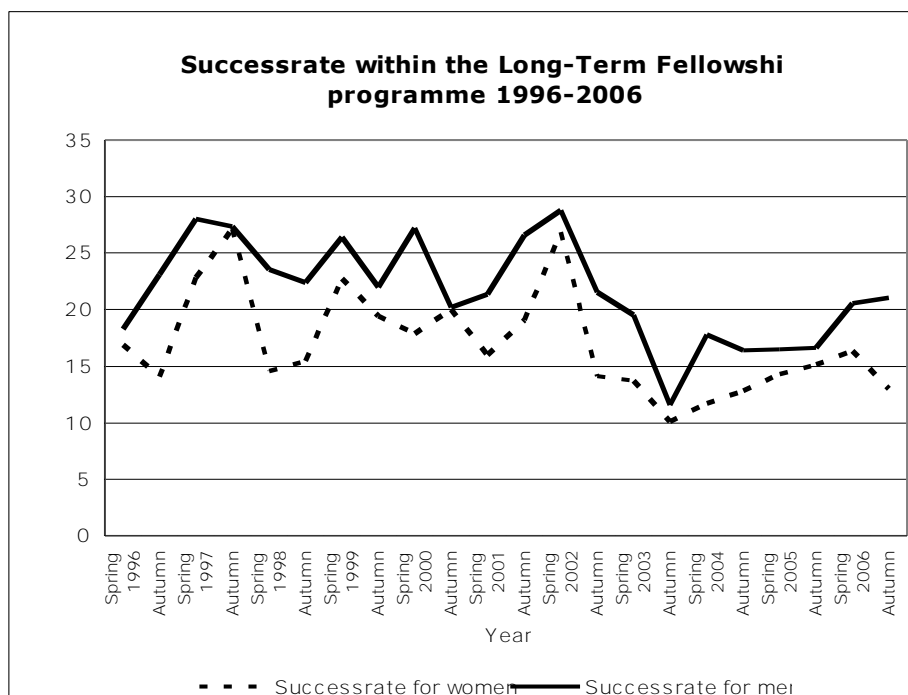
Abstract English

In this study, we investigate the influence of gender on selection processes and careers, based on the observation that female applicants consistently have lower success rates than male applicants when applying to the European Molecular Biology Organization's (EMBO) Long-Term Fellowship (LTF) Programme. We gathered the full bibliometric data of all applicants to the LTF programme 1998 and found that female applicants produce fewer publications and we conclude that this is the major reason for the difference in success rate. To identify the underlying causes for this gender gap we sent out a questionnaire to the applicants regarding their career development, private life and motivations eight years after application. Several lines of evidence suggest that the female applicants' lower success rate and weaker publication record can at least in part be explained by women adjusting their own careers to that of their partners. We found that more female respondents have a partner with a PhD degree than the male respondents (62% vs. 44%). More importantly, a higher proportion of the female respondents had moved due to their partner's work compared to the male respondents (51% vs. 18%). In addition, female respondents with children work fewer hours than male respondents with children, and the majority of the female respondents with children have a partner who works more than 46 hours/week compared to only 19% of the male respondents, indicating that in a partnership with children women's careers take second place.

1 Introduction

A meta-analysis of 21 studies has shown that “among grant applicants men have statistically significant greater odds of receiving grants than women by about 7%” (Bornmann, Mutz, and Daniel 2007, p. 226). According to the numbers of applicants and beneficiaries of research funding in Europe, available in the “She figures 2006” from the European Union (EU), women generally have a success rate of 36% compared to 43% for men (European Commission 2006). This imbalance between men and women is also seen in research institutes and at universities. Across the EU as a whole, less than a third of all researchers are women. In the business and enterprise sector, 18% of all researchers are women, while only 15% women are to be found at the highest grade in higher education (grade A; equivalent to a full professor).

Figure 1. Male applicants consistently have a higher success rate than female applicants (source: EMBO Fellowship Report 2006)



European Molecular Biology Organization (EMBO) has been offering Long Term Fellowships (LTFs) since 1966. Gender disaggregated statistics for the EMBO LTF-programme are available since 1996. The difference in success rate for men and women varies and, on average, the female success rate is 20% lower than that for men (see Figure 1) (see here for the explanation Ledin, Bornmann, Gannon, and Wallon 2007). This difference has persisted despite the committee's awareness of and commitment to gender equality, and despite the fact that EMBO, in recent years, has received an almost equal number of applications from men and women.

In our study, we investigated the influence of gender on selection processes and careers, based on the observation that female applicants consistently have lower success rates when applying to the European Molecular Biology Organization's (EMBO) Long-Term Fellowship Programme (LTF). We gathered the full bibliometric data of all applicants to the LTF programme 1998 and found that female applicants produce fewer publications than male applicants prior and subsequent to application. We concluded that this is the major reason for the difference in success rate when applying for the EMBO Fellowship (Ledin et al. 2007). To identify the underlying causes for this gender gap we sent out a questionnaire to the applicants regarding their career development, private life and motivations eight years after application. In this report, we will focus on the results from the questionnaire.

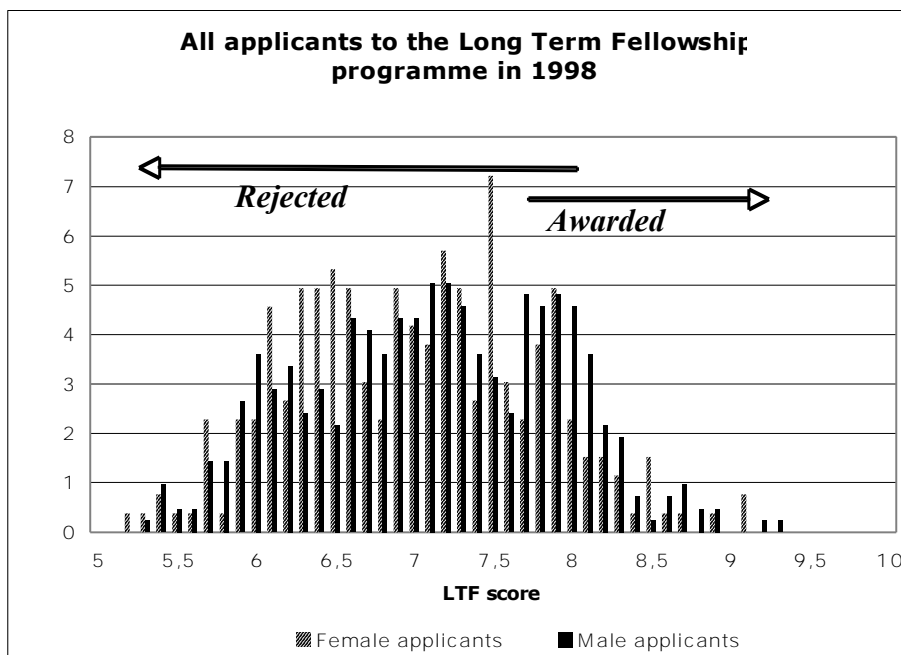
2 How to become an EMBO Long-Term Fellow

The selection procedure for the EMBO LTF includes a personal interview of each candidate by an EMBO member who is an expert in the applicant's area of research, and an individual score by each of the 10 members of the selection committee. The scores are based on the research proposal, the applicant's publication record, the quality of the proposed host laboratory, the interview report and the letters of reference. The procedure results in a score between 1-10 (in practice between 5 and 9.5) for each application. Scores for individuals are usually fairly uniform across all committee members, an indication that there is a uniform perception among the committee members about what is a good proposal. Any major discrepancies in score and the allocation of awards are discussed during the meet-

ing of the committee. In 1998, the Fellowship committee consisted of eight men and two women, one of the women served as the chair of the committee.

Figure 2 shows the proportional distribution of all male and female applicants in 1998 according to their respective scores. On average, men were scored 7.12 while women on average were scored 7.01. The cut-off score for awards in 1998 was between 7.7 up to 8.0 – and the main reason for this floating award-border is that a higher score is required for an award if the applicant applied for a laboratory outside Europe.

Figure 2. Proportion per score of male vs. female applicants



3 Methods

We developed an on-line questionnaire that was open to the 1998 LTF applicants during summer 2006. We were able to track down 85% of the email addresses of the 680 applicants and asked them to fill in the questionnaire. Of all notified ap-

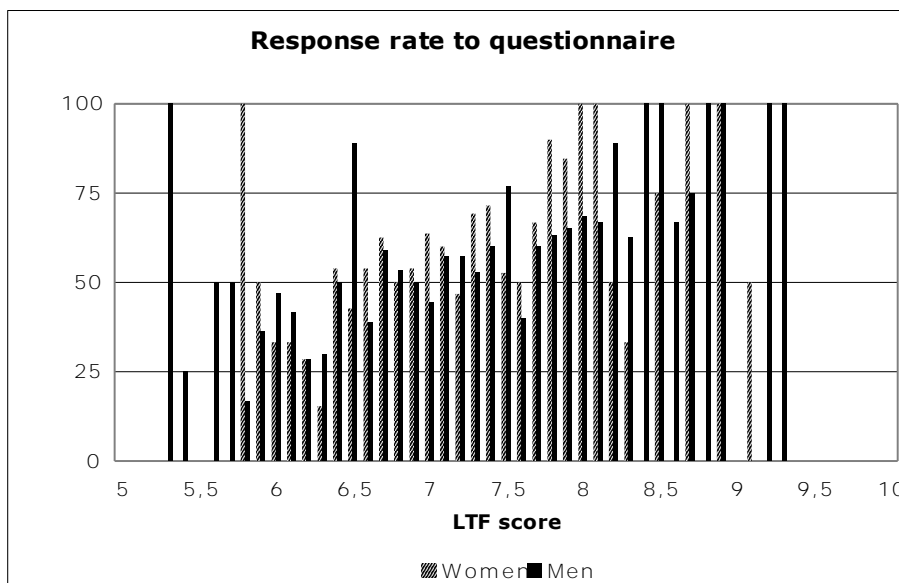
plicants 69% responded, but some (8% of the total) declined to participate in the questionnaire (see Table 1).

Table 1. Responses to the questionnaire

	Total applicants	E-mailed	Responded	Declined	True responses	Responses of all applicants
Number	680	577	444	46	398	398
%	100	85	77	8	69	59

As seen in Figure 3 the response rate is quite evenly spread out over the given LTF score for both men and women – 57% of all female applicants filled in the questionnaire and 59% of all men. The responses to the questionnaire can thus be seen as representative for the group. Furthermore, eight career-years have passed from the time of application to the LTF programme, hence, these applicants are in the middle of their scientific career-tracks today – which truly make their reflections and thoughts significant for our study.

Figure 3. The respondents to the questionnaire are representative of the group of applicants



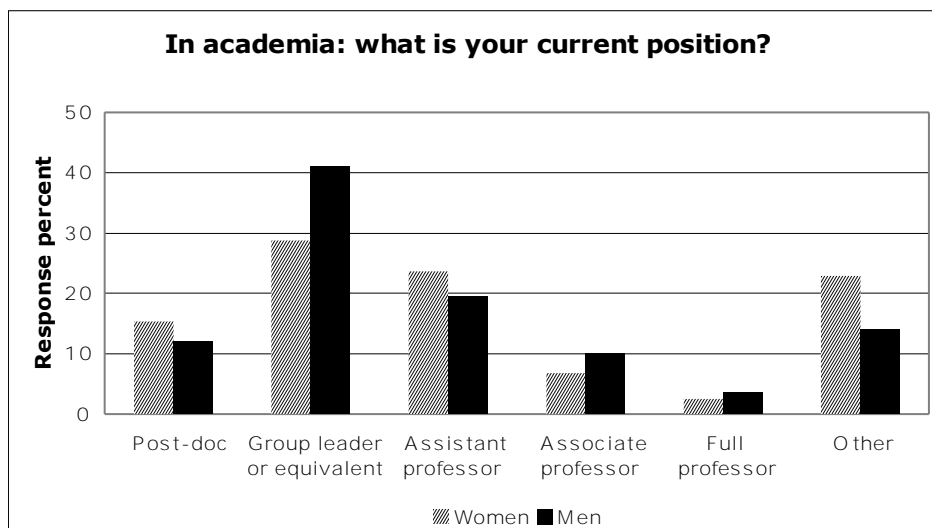
4 Results

4.1 Present positions

Employment in academia

As many as 80% of all male and female respondents are still working in academia; such as universities, research institutes or equivalent and a majority (56%) hold a permanent position, no difference between men and women. Notably, almost all of the respondents who still work in academia (99%) state they have a research activity and the majority of them has a position as group leader or equivalent (Figure 4). Of the respondents who still work in academia but specified their position as “Other,” the vast majority have an employment as either staff scientist or various forms of principal investigator.

Figure 4. The majority of all respondents have a position as a group leader or assistant, associate or full professor. 56% have a permanent position



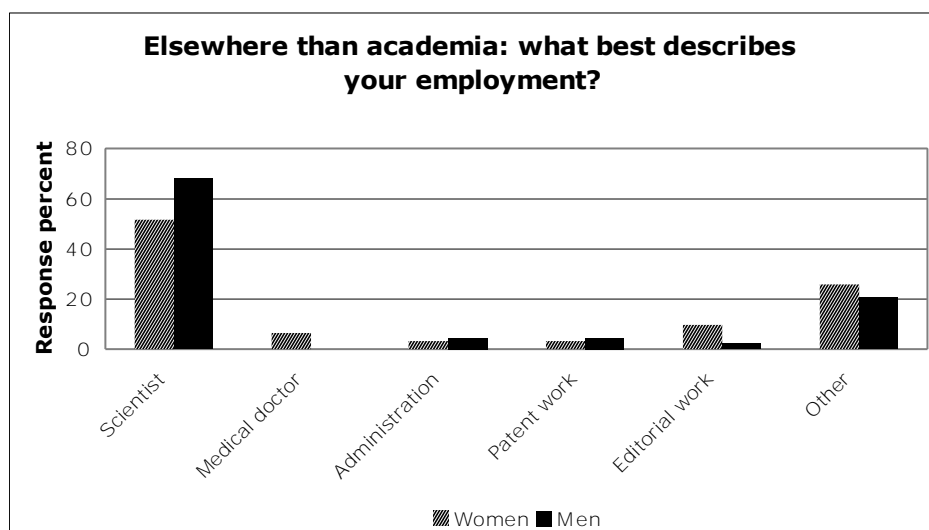
Both men and women state that the top three major reasons for them to stay in academia are: academic freedom, focus on scientific research and the possibility to work flexible hours. On the other hand, the majority of the respondents within academia point out that administrative tasks and lack of long-term funding is a

problem with doing research in academia. Despite administrative tasks and search for grants, the majority of the respondents working in academia are satisfied with their working conditions (70% of the women vs. 65% of the men). However, 50% of both male and female respondents are dissatisfied with their prospects for advancement, yet only 15% would prefer to work in a non-academic environment (12% of the female respondents vs. 18% for the male).

Employment elsewhere than in academia

20% of all respondents have an employment elsewhere than in academia, no difference between the sexes; and the majority of them (more than 75%) left academia after their post-doctoral time. Lack of permanent positions in academia is often brought up as a major problem for pursuing an academic career, and a permanent position is actually being held by more applicants working elsewhere than in academia compared to applicants still working in academia (76% permanent position „outside“ academia vs. 56% within academia), with no difference between male and female applicants. Around 50% of those who left academia work in industry, with no difference between male and female applicants. As seen in Figure 5, most respondents working elsewhere than in academia describe their present employment as “Scientist” and state that they have a research activity, even though the proportion is higher for the male respondents than female (68% vs. 52%). Around 20% of both men and women who do not work in academia describe their employment as “Other,” which according to their own descriptions often seem to be consultancy or business related work tasks.

Figure 5. Of the respondents who work elsewhere than in academia, most work as scientists. 76% have a permanent position



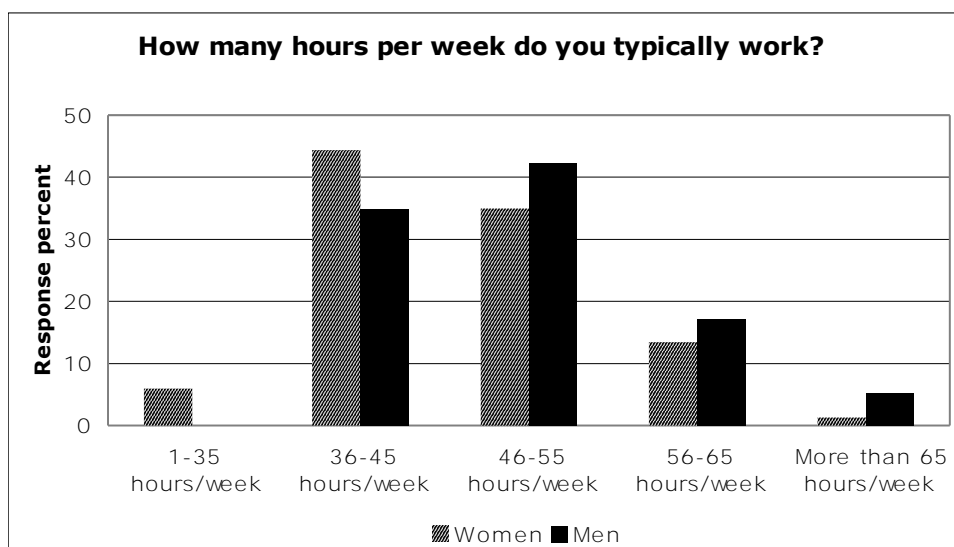
Notably, the main reasons for leaving academia differ between men and women: most men mark that “Career perspectives were unclear” as the motive why they left academia, while women equally mark that “Return for effort was unsatisfactory,” “Research demanded excessive focus on just one topic,” “Salary level unsatisfactory” and “Lack of positions in an intermediate level.” However, there are no differences between men and women to the following choices, when they were asked why they left academia: “Too competitive,” “Lack of job security” and “Lack of support by supervisor.” Hence, the female applicants to EMBO’s LTF programme do not seem to leave academia in a greater proportion than their male counterpart due to competitiveness, nor lack of security or supervisor support. Interestingly, 45% of the female and 30% of the male respondents who work elsewhere would have liked to stay in academic science but not as group leader. In view of that, it is therefore not surprising that almost 40% of those who do not work in academia would prefer to work in academia if they had the option, and around 20% have actually tried to return to an academic position.

4.2 Working hours

Science has both a tradition and a reputation of demanding many work hours in order to succeed – which eventually can work against scientists who try to com-

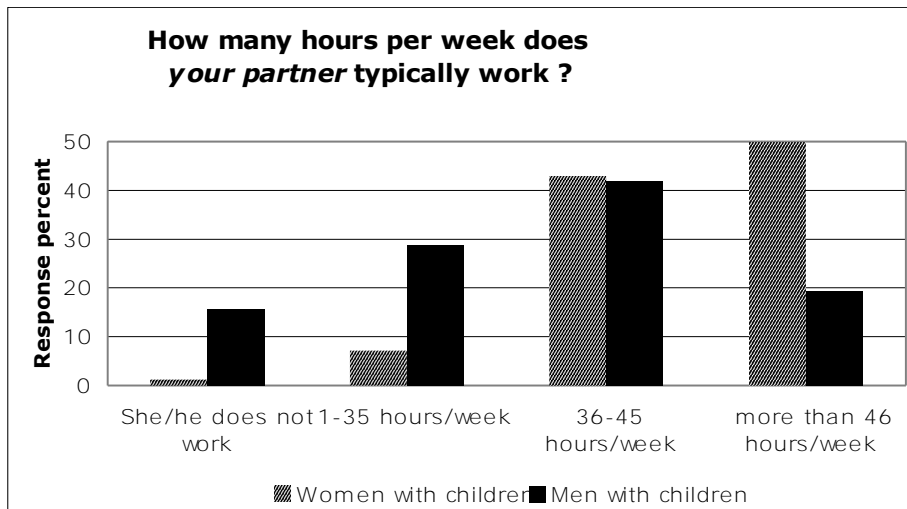
bine a scientific career with a family. We asked the applicants how much they actually work. Most of respondents work full-time: 80% of both men and women state that they work 36-55 hours/week. 6% of the female respondents work less than 35 hours/week, compared to just one man, as seen in Figure 6 below.

Figure 6. The majority of all respondents work more than 36 hours per week.



When asked how many hours they were willing to work, as an indicator of their attitude towards intensive work-load, a higher proportion of men replied that they were willing to work more than 46 hours/week compared to women (64% vs. 51%). This might indicate that women are less willing to apply or accept more time demanding work tasks, thereby also risking their career to be less successful. Remarkable is that among men with children as many as 57% indicate that they are willing to work more than 46 hours/week compared to only 34% of the women with children. 74% of the male respondents with children compared to 37% of the female respondents with children work more then 46 h per week. One may speculate that women with children have more family responsibilities than men, and thus lack the extra hours that men can devote to work.

Figure 7. The female applicants to EMBO’s LTF programme in 1998 more often have a partner who works more than 46 hours/week



A strong indicator that this really is the case is seen in Figure 7, when comparing how many hours the partners of the applicants with children work; 44% of the men with children have a partner who works less than 36 hours/week and only 19% have a partner who works more than 46 hours/week. The opposite is seen for women with children: only 7% of the women have a partner working less than 36 hours/week but instead 50% of their partners work more than 46 hours/week. Hence, even if most applicants have a working partner – it is clear that male applicants more often have a partner who works less compared to female applicants. The implication of this difference in partner’s investment towards the daily workload in a family with children is therefore a potential threat for women’s careers.

4.3 Family matters

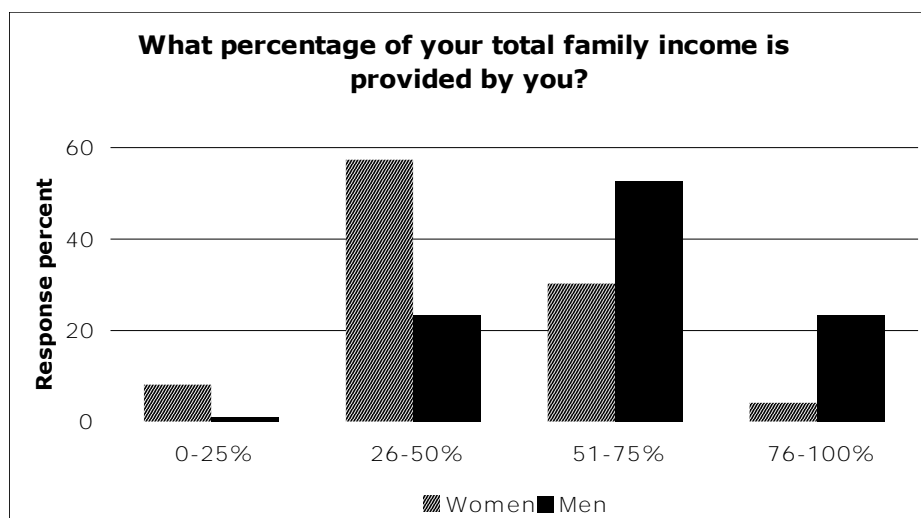
As we have already seen, there is a big difference when it comes to how much the LTF applicants’ partners work: female applicants have a partner who works much more than male applicants’ partners do. Considering that the majority (95%) of the 1998 LTF applicants who responded to the questionnaire were between 34 and 42 years old, it is not a far-fetched thought that many of the applicants are juggling work and children (see below). Indeed, children are a time consuming factor but they can also be seen as a parameter that offer both balance and reflection to a

career. With the family related questions in the questionnaire, we wanted to know whether the female applicants adjusted their career to their partners and children to a greater extent than the male applicants.

Partners' careers

Around 90% of both women and men have a partner. 60% of the female applicants have a partner working within science while just 46% of the male applicants' partners also worked in science. The education level of the respondents' partners is very high: around 90% of both men and women have a partner with a university degree (PhD, MD, MSc, BSc or equivalent), nevertheless 62% of the women have a partner with a PhD compared to 44% of the men. A high educational level often leads to qualified positions with responsibilities and the need to work more intensively during certain periods. Since more female than male applicants have partners with a PhD degree, it is reasonable to believe that negotiations when weighing in his or her career occur more often for the female applicants than for the male.

Figure 8. The male applicants provide a bigger proportion to their families' income than the female applicants



Moreover, a higher proportion of the female applicants moved because of their partners' work than the male applicants (51% of the women, 18% of the men) and the same goes the other way around: more of the male respondents had a partner

who moved because of their work (72%) than the corresponding women (50%). It thus seems that by having a partner with a high education level, more female applicants stand back in their own career compared to the male applicants. Moving can be a win-win situation for both parties in a relationship and dual careers are possible. But still, one cannot ignore the fact that female respondents more often moved due to their partner's work than the male applicants did. It is thus an apparent risk that the female applicants' careers are adapted to fit their partners, thereby developing less optimal than they could.

Most female respondents (57%) reply that they provide 26-50% of the total family income, in contrast to the majority of the men (53%) whose contribution to the family income is between 51-75%, as seen in Figure 8. Male applicants thus seem to both work and earn more than their partners, which indicates that the male applicants' careers are more valued than the female applicants' in their respective relationship.

Children's impact on career

63% of the respondents have children: 61% of the women and 69% of the men. The equivalent numbers in 1998, at time of application were: 18% of all applicants had children, 13% of the women and 21% of the men. Of the women who still do not have children, 63% plan to have children in the future, and so do 70% of the child-less men.

Most respondents with children have two children (48% of the women vs. 43% of the men), and the first child was often born after the post-doctoral period (50% of women and 37% of men). Childcare is accessible to almost all of the respondents with children (90%), and a majority have full-time child-care (70%). The majority of female respondents took 4-6 months off in parental-leave in total, so given that most respondents have 2 children; the average maternity leave was 2-3 months per child. When the respondents informed their supervisor that they were to become parents, men more often experienced a neutral reaction from their supervisor than women did (46% of the men compared to 33% of the women). In contrast, women more often experienced doubt on whether their scientific career could be combined with children (21% of the women compared to 4% of the men), in addition to getting less support but more criticism than before they became parents (women 21% vs. men 6%).

4.4 Encouragement and motivation

To find out if there are sex-differences in attitudes that can explain the variations in scientific production, we included a number of questions regarding the applicants' motivation and encouragement. Almost 90% of the respondents were encouraged by their PhD supervisor to apply for a post-doctoral position, and there is no difference between male and female respondents in terms of being encouraged by their PhD supervisor.

Neither can we find any differences between the male and female respondents when they were to mark what personal characteristics or factors had helped them the most during their career. "Persistence and endurance" was marked as the most important personal characteristic, followed by "Self-motivation," "Curiosity" and "Ambition and determination." When asked to rank the importance for a variety of career- and family-related factors, it is remarkable how similar men and women are. "Inventing or discovering something significant" and "Being successful at work" are ranked as two very important factors for the LTF applicants, independent of sex.

The option to work part-time for a certain time is another factor where a majority of the applicants agree: around 70% of all male applicants (with and without children) and female applicants without children considered this to be "Not so important." In contrast, 60% of the female applicants with children consider the possibility of working part-time for a certain time to be important, although 80% of the female applicants with children work more than 35 hours/week.

The respondents were also asked to agree or disagree to a number of provocative statements made in the questionnaire. As can be seen from Table 2 male and female applicants seem to have the same opinion on most points. Hence, male and female respondents stated unanimously that: 1, they do not feel excluded from informal networks at their work; 2, they believe it is possible to combine a scientific career with a family; 3, they receive a fair amount of respect and responsibility in their workplace; and 4, that their boss would respond positively to a request for flexible working hours. However, more female respondents than males believe that men get more career support from supervisors, and that a quota system for women in scientific positions will have a positive effect for both women and science. Moreover, one out of four female respondents state that a glass ceiling for

women exists at their workplaces, which actually 9% of the male respondents also agree to. 22% of the female respondents have furthermore witnessed negative discrimination of women at their work place, a number that grows to 34% when applicants to EMBO's Young Investigator Programme (catering to the early group leader stage) are asked (see here the results in Ledin et al. 2007).

The applicants were asked if they had a mentor, i.e. a person to whom they can turn for advice with their professional lives. Many respondents do have someone who they would describe as their mentor (38% of the female vs. 32% of the male respondents) but interestingly, of those who don't – more women than men would like to have one (69% of the female vs. 48% of the male respondents). This difference becomes even more significant when we asked the applicants to the EMBO Young Investigator Programme (Ledin et al. 2007). There 32% of the women had a mentor vs. 49% of the men, and more significantly 71% of the women wanted a mentor vs. 46% of the men. Hence, men more often have the professional support that women wish for.

Of those that do have a mentor, more than 90% of both male and female applicants state that the mentor has been useful to them, and the mentor and mentee normally are in contact between anything from once a day to 2-6 times per year. The most common way to find a mentor seems to be through the applicants' own efforts, as stated by more than 60% of both male and female respondents who have a mentor.

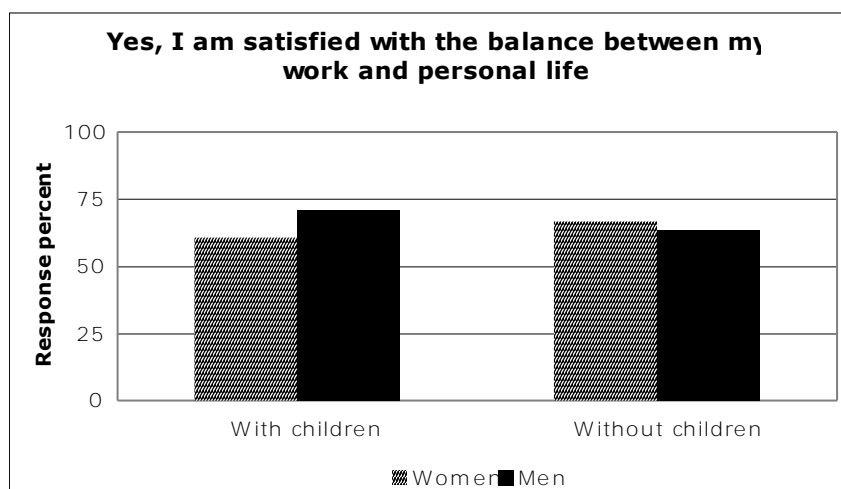
Table 2. Agreement or disagreement to a number of provocative statements made in the questionnaire

<i>Do you agree or disagree with the following?</i>	<i>Agree (%)</i>		<i>Neutral (%)</i>		<i>Disagree (%)</i>	
	<i>Women</i>	<i>Men</i>	<i>Women</i>	<i>Men</i>	<i>Women</i>	<i>Men</i>
I have to work an unreasonable amount of hours to succeed	46	33	24	42	30	26
I feel excluded from informal networks at my work	13	9	37	41	50	50
I believe that taking parental leave is held against those who do so	34	22	38	49	28	29
I suspect that I was chosen for my current position partly because of my gender	4	4	13	15	83	82
Men get more career support from supervisors	43	14	29	37	28	49
I believe it is possible to combine a scientific career with a family	57	66	28	26	15	8
A glass ceiling for promotion of women exists at my workplace	24	9	47	42	29	49
A quota system for women in scientific positions will have a positive effect for women	43	19	32	42	25	39
A quota system for women in scientific positions will have a positive effect for science	35	11	43	44	23	45
I receive a fair level of respect and responsibility in my workplace	74	68	15	25	10	7
My boss would respond positively to a request for flexible working hours	47	43	26	41	26	16
I have witnessed negative discrimination against women at my workplace	22	7	22	21	56	72
I have been negatively discriminated against at work because of my gender	13	3	23	10	64	87

Satisfaction with work and personal life

We finally asked the respondents if they were satisfied with the balance between their work and personal life. The majority of the respondents were satisfied, 63% of all female respondents vs. 65% of all males. Respondents with children seem to be at least as satisfied as respondents without children, i.e. 68% of all respondents with children were satisfied with their balance between work and personal life compared to 65% of respondents without children. Hence, given the challenge of combining a scientific career with children, most of the parents still think it is worthwhile doing it. Interestingly though, among all respondents, fathers are the most satisfied (71%) followed by women without children (67%), men without children (64%) and lastly mothers (61%), as seen in Figure 9.

Figure 9. Male applicants with children are the group that is most satisfied with their balance between work and personal life



5 Discussion

The LTF programme at EMBO is one of Europe's most prestigious fellowship programmes and it is a cornerstone in EMBO's mission to promote European excellence in the molecular life sciences. However, in EMBO's Long-Term Fellowship programme there is a lower success rate for female applicants compared to male applicants, meaning that a higher proportion of male applicants are awarded the post-doctoral fellowship than female applicants. In our investigation, we found that female applicants produce prior and after application fewer publications than male applicants. A questionnaire was used to investigate applicants' career development, private life and motivations in order to find explanations for this gender difference. Several lines of evidence suggest that the female applicants' weaker publication record can to a large part be explained by women adjusting their own careers to their partners' careers. We found that more female respondents have a partner with a PhD degree than the male respondents (62% vs. 44%). More importantly, a higher proportion of the female respondents had moved due to their partner's work compared to the male respondents (51% vs. 18%). In addition, female respondents with children work fewer hours than male respondents with children, and the majority of the female respondents with children have a partner who works more than 46 hours/week compared to only 19%

of the male respondents, indicating that in a partnership with children women's careers take second place. As a consequence most female respondents provide less than half of the total family income, in contrast to 76% of the male respondents who contribute to more than half of the total family income.

Traditional gender roles thus seem to hold back female scientists.

Notably, we cannot conclude any difference between the male and female applicants' career motivations when asked about what personal characteristics or factors that had helped them the most during their career. The wish for having a mentor, i.e. someone to turn to with professional matters, is greater among the female than the male applicants. In contrast to that, fewer females actually had a mentor. We finally asked the respondents if they were satisfied with their balance between work and personal life, and indeed most respondents were. Male respondents with children were the most satisfied group, followed by the respondents without children and lastly female respondents with children.

The data we present points to a pervasive culture of negative bias – whether conscious or unconscious – against women in professional life, resulting in a lack of professional support and networking. This same culture also ascribes women traditional roles in the home and, together, these factors constitute a harmful mix that leads to women being less successful than men over the course of their careers. Our findings tally with the conclusion of the National Science Foundation (2003) on gender differences in the careers of academic scientists: “Taken as a whole, the body of literature we reviewed provides evidence that women in academic careers are disadvantaged compared with men in similar careers. Women faculty earn less, are promoted less frequently to senior academic ranks, and publish less frequently than their male counterparts” (p. 1).

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Biographical notes

Dr. Anna Ledin (Anna.Ledin@kva.se) works as a scientific secretary at the Royal Swedish Academy of Sciences in Stockholm, Sweden. After defending her PhD thesis in molecular immunology at Uppsala University, Sweden, she took up an administrative position at the European Molecular Biology Organization, EMBO, in Heidelberg, Germany where she evaluated two EMBO programmes. At the Royal Swedish Academy of Sciences, she is coordinating the Academy's international contacts and Academy responses to government matters.

Dr. Lutz Bornmann (bornmann@gess.ethz.ch) is a researcher at the Professorship for Social Psychology and Research on Higher Education of the ETH Zurich. Since the late 1990s, he has been working on issues in the promotion of young academics and scientists in the sciences and on quality assurance in higher education. He is a member of the editorial board of the *Journal of Informetrics*. Since 2004, he has published nearly 40 papers in journals covered by Thomson Reuters with a total of more than 300 citations. His academic interests include research evaluation, peer review and bibliometric indicators, especially the *h* index.

Dr. Gerlind Wallon (wallon@embo.org) is the deputy director of the European Molecular Biology Organization (EMBO) and manager of the EMBO Young In-

investigator Programme and the Women in Science actions. A German native, she graduated with a PhD in Biochemistry from Brandeis University, Waltham, Massachusetts, USA, and gained 4 years of post-doctoral experience in basic research at the EMBL in Heidelberg. She has written several articles on women in science and has organized two EMBO meetings on the topic.