supporting women scientists by helping them to raise their children.

Finally, many women feel strongly that academic science is a working environment that favours what are perceived as

Ruth Arnon: 'There is a glass ceiling, but if you're strong-headed, you can break it.'

being male characteristics—aggressiveness and competitiveness. 'I think we essentially suffer from the fact that success is measured by a male yardstick,' Daniela Rhodes from the MRC said. She also expressed her disappointment with the fact that only a few men attended the

conference as the issue of gender equality affects them as well.

Indeed, it is a problem that men and society cannot afford to ignore. It is becoming increasingly difficult to attract young people to pursue a career in the life sciences, so it only makes matters worse if one-half of them are left behind. And, as Helga Ebeling from the German Ministry of Education and Research pointed out, with every woman leaving science, Germany loses around 1 million Marks (500 000 Euros) of public and private investments into her education and career. 'For me the strongest argument is the efficiency argument: it is wasteful to educate and train young women scientists but then not to use their skills in employment,' Osborn said.

There is no doubt that there is a glass ceiling for women in the life sciences. But it seems that it has been rising over the last few years, which could clearly be seen among the panelists who discussed the problem of discrimination. While the older women in higher positions talked about experiences of outright discrimination that they faced from their male colleagues, it was encouraging that the younger women did not yet share their experiences. Elena Conti and Sonja Schwarzl, a graduate student at the University of Heidelberg, expressed their opinion that women nowadays are in general regarded as equal professionals.

Furthermore, a greater awareness of gender issues as well as more support for young women have removed many of the obstacles that older women had to face in their careers. 'The common knowledge in the lab these days is that it's easier for a woman to be in science than for a man to be in science,' Conti said.

The expectation is that with many male professors retiring and more women climbing the career ladder, the glass ceiling will rise further until it eventually disappears. Hopefully, many of the younger women will not face the problem of unequal treatment at all. However, for those who reach the ceiling, it is up to them to stay in or leave science. And this decision is independent of any man-made or other obstacles. 'There is a glass ceiling, but if you're strong-headed, you can break it,' Arnon said.

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Searching for discrimination

Are women treated fairly in the EMBO postdoctoral fellowship scheme?

The publication of the Swedish Medical Research Council's analysis of its grant selection scheme (Wenneras and Wold, 1997) came as a wake-up call for many other funding agencies in the life sciences. As it showed an inherent discrimination against women applicants, many of those responsible for giving grants to young scientists became worried. It was indeed appalling to read that women in the Swedish system needed 2.5 times more publications to be successful, but the question was asked whether this was an isolated case? Furthermore, how would

other funding programmes fare if subjected to the same scrutiny as the Swedish Medical Research Council?

Such questions triggered an analysis of the EMBO Long Term Fellowship granting

that, at face value, there does seem to be a bias. Further analysis of the data, however, could also point to a slightly lower quality of the female applicants when judged by certain criteria. Figure 1

When the success rate is calculated for the spring and autumn session for the years 1996–2001, the female applicants were, on average, 20% less successful than the males

scheme in order to find out whether there is any similar discrimination within this programme. The troubling outcome was

illustrates the potential problem. When the success rate is calculated for the spring and autumn session for the years

analysis

Fig. 1. Percentage of accepted female and male applicants for the EMBO Fellowship scheme over the years 1996–2001.

1996–2001, the female applicants were, on average, 20% less successful than the males. Such a consistent result suggests that there may be a systematic bias against women scientists in the decision-making process.

In all cases, the committee members gave a higher average score to the male cohort than to the female

To discover the source of this bias, each step in the selection process was thoroughly examined. Here, the cohort from spring 1998 was chosen for analysis since this group displayed one of the largest discrepancies in success rate between the sexes. Overall, 372 people—221 men and 151 women—applied for an EMBO fellowship, of which 74 were chosen. All applicants were of the same age group and there was no obvious difference in the quality of the laboratory they chose for their fellowship. Of the successful applicants 52 men obtained a fellowship and 22 women, thus the success rate of men was 23.5% and that of women 14.6%.

The Swedish study pointed out that female scientists needed more papers of higher quality to be successful. This appeared to be the case for the EMBO scheme too. The average number of papers of all female applicants was 4.9 and that of all males 5.4. However, the successful women had published 7.1 papers and the men 5.8. Therefore, it

could be concluded that for a woman to be successful, she needed to have published more papers than her male counterpart. But closer examination of the quality of the publications—judged by their total impact factor—gave a further perspective. The average male applicant had papers of a higher total impact factor (15) compared with females (13.2) and this was mirrored in the successful males (28.8) compared with the successful females (24.2). Equally, the males needed slightly more first author papers—3.4 versus 3.1—of a higher impact factor (26.9 compared with 24.0) to receive a fellowship. One could conclude, therefore, that by this criterion it was actually more difficult for men to receive an award.

Obviously, the bias is not in the number of publications needed but must be hidden in the selection process itself. Applicants are first interviewed by an

committee member who is then asked to submit a report. Given that almost 90% of EMBO members are male, it might seem plausible that this was the source of the bias. But this was not the case with both sexes receiving equally positive assessments. These reports, together with all the information provided by the applicant, are then sent to a ten-person committee. The members of the committee indepen-

dently score each application and these figures are tabulated. At the selection meeting, these data are then discussed among the committee, which can result in minor changes made to the scores. Although the committee knows the personal details of each applicant, those discussions are never about criteria other than their scientific quality. In all cases—and there were two females, including the chair, on the committee—the committee members gave a higher average score to the male cohort than to the female (Figure 2).

The fact that the successful females had a higher average number of papers may indicate that their results have been parcelled into a larger number of less consequential papers

results have been found throughout the whole of the 1996–2001 period, despite a rapid turnover in the composition of the committee members. The second explanation is that the committee focuses on some subtle combination of qualities, which leads to the uniform response of its members. If a high sensitivity to the quality of the publications as opposed to simply their number predominates, then it

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analysis

Fig. 2. Average grades awarded to male and female applicants by each committee member, Spring 1998.

could be concluded that the quality of the female applicants was slightly lower than that of their male colleagues. The fact that

have been magnified in the selection process. One could claim that women needed a greater number of publications

is to discover—if there are—sources of bias against women and the means to ensure that these are eliminated during the decision-making process. Studies such as this may help to raise the consciousness of the decision-makers on the problem and to find and dispel any deep-rooted bias that may have an unfair influence on the judgement of fellowship applications.

One could claim that women needed a greater number of publications in order to be successful, but the data equally illustrate a need for men to have publications with a higher impact factor

the successful females had a higher average number of papers may indicate that their results have been parcelled into a larger number of less consequential papers. Why this phenomenon is more prevalent in one sex is unclear unless there is a signal in the fact that the males had a slightly higher number of first-author papers. Could it be that the females were more co-operative in their home laboratory and then were placed in middle authorship positions with the consequent message to the panel that they were less focused on their work?

The conclusion of this study is therefore untidy; a tiny difference between the female and the male applicants appears to

in order to be successful, but the data equally illustrate a need for men to have publications with a higher impact factor. Crass discrimination against women therefore does not take place, but there is something wrong in a system that consistently results in a lower success rate for female scientists.

The problem of the lower number of women in the scientific system as they move through their careers has been highlighted in many reports (ETAN report on Women and Science, 2000) and many measures to overcome male dominance in academia have been discussed. The biggest challenge for granting schemes, such as the EMBO fellowships, however,

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