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CAREER FEATURE

When mentoring matters: A French mentoring program for women in science

An innovative program addresses the need for support, encouragement and guidance of women scientists in the early years of their career, during their PhD

In 2017, in the European Union, the share of women in knowledge-intensive activities was 44.4%. However, in many countries women involved in scientific research are severely under-represented, for example, 33% in the EU and 28% in France^{1,2}. European companies employ 20% of female researchers, a trend followed by France^{1,2} (**Fig. 1**).

At French universities, the proportion of female students studying science varies according to discipline, with a clear preference for life and biomedical sciences (62% of students) over fundamental and applied sciences including mathematics, physics, chemistry and computer sciences (26% of students)³. While young women are not afraid to engage in scientific studies early on, they often have to deal with several obstacles in a very masculine environment, including a general lack of support, ever-present and pervasive gender bias and several forms of harassment, which lead them to develop a lack of self-confidence with respect to their professional abilities and to question their professional future. Over the past decades, many women have thus left their field to pursue personal rather than professional objectives after their PhD. In our so-called evolved society in which balancing professional and personal life appears to be critical for self-fulfillment, neither men nor women should have to choose between these goals. A general lack of support to encourage young women to progress and value their scientific expertise and skills, together with a relatively low proportion of female role models in science, is largely responsible for the drop in their incentive to pursue a scientific career beyond the PhD.

To address the need for support and guidance of female scientists in the early years of their career, a wide variety of mentoring programs have been developed in academic settings throughout Europe and the United States⁴⁻⁶. Although their format varies considerably all share the common incentive of providing support, guidance and personalized advice and of helping mentees reflect on their career path choices thanks to experienced mentors and training workshops. However, with no mentoring programs specifically directed towards female PhD students available at French universities until 2014, Femmes & Sciences (<https://www.femmesetsciences.fr/>), an association founded in 2000 that promotes science and technology and supports women throughout their scientific careers, pioneered a program that provides a nurturing environment for PhD students to discuss issues, seek guidance to plan their career path and learn how to value their skills with a network of experienced scientific mentors. The program was launched at the University of

Montpellier in 2015 with the support of the Doctoral College⁷. Similar programs were established at the University of Toulouse in 2017 and at Paris-Saclay University in 2019, more recently at the University of Nice (or Nizza), and further expansion in Strasbourg, Lyon, Grenoble, Bordeaux and other Parisian universities-expected in the near future. Coordinated and driven by Femmes & Sciences member volunteers, this innovative programme bridges research laboratories and doctoral schools, who fully recognize and support the program. The main objective is to support, guide and train young female scientists at an important stage of their career by providing them with an opportunity to benefit from unique and tailored advice from experienced scientists, to meet and learn from role models and to participate in group discussions and training sessions.

Setting the stage: Content and structure

The mentoring program consists of three complementary schemes: regular one-on-one mentor–mentee meetings, group meetings to discuss issues concerning women in science or to attend presentations by established female scientists (testimonies), and career development workshops (**Fig 2a**). The sequence of mentoring circles, testimonies and career development workshops are deliberately alternated throughout a 12-month period (**Fig 2b**). Mentees can select as many group meetings as they wish to attend from the panel of mentoring circles, testimonies and workshops proposed by the program coordinators throughout the year.

Mentor–mentee pairs meet regularly (ideally once a month) to talk about the PhD itself and the mentee’s career goals, to discuss specific issues related to the thesis and any obstacles beyond, as well as doubts or concerns raised by the mentee. The mentor listens, guides and provides personalized advice to help the mentee think about her career choices and perspectives. Each mentor–mentee pair is unique, as the specific needs of a mentee may vary significantly, and the mentor will tailor advice based on her/his own professional and personal experience.

Mentoring circles are group meetings led by one or several mentors, during which both mentees and mentors discuss specific topics determined at the beginning of the year. Some of the most popular mentoring circle themes concern work/life balance, careers in academia versus the private sector, careers in France or abroad, and self-confidence. Mentoring circles are generally held during lunch or a light dinner to encourage an informal atmosphere.

Testimonies are presentations describing the career paths of established female scientists whose career choices and strategies within and beyond academia may inspire mentees. For example, an editorial writer, a company CEO and a scientific culture communication expert were

invited to describe their daily job and career paths after their PhD in the mentoring program in Montpellier.

Career development workshops provide coaching and training for essential career development steps; for example, corporate presentation, preparing a postdoc abroad, and professional networking.

A steering committee consisting of members of Femmes & Sciences affiliated with universities, public research institutions, or from the private sector, oversees the program's progress, deciding on the content and coordination of the mentoring circles and workshops, assessing new needs, addressing problems and evaluating the program annually. Upon engaging in the program, both mentors and mentees must agree to the mentoring charter, which contains basic rules to ensure reciprocal respect as well as mutual consent to engage in regular meetings and commit to the 12-month duration of the program. Mentors do not substitute the PhD supervisor in any way, but engage in a positive and constructive relationship to support and guide the mentees throughout their PhD and beyond in their search for a postdoctoral position in academia or a job in a private company.

Program participants

Mentors are experienced scientists, female or male, who hold a PhD and may work in academia or industry. They are integrated in the program following training that provides them with basic guidelines and recommendations as to their role and limits⁸⁻¹⁰. Their role consists of active listening, guiding and encouraging the mentee: explaining how the system functions, formal rules and know-how based on her/his own professional and personal experience. While a PhD supervisor teaches her/his student specific techniques and skills in well-defined scientific field, the mentor will accompany and nurture the mentee, passing on several less well-defined keys to success based on her/his scientific background, career path and experience. Mentors may also introduce a mentee into scientific networks, explain the importance of establishing professional networks and recommend strategies that will be important for the mentee's career path and professional development¹¹. As volunteers mentors do not receive any compensation for their participation in the program.

The number of mentors and consequently of mentor–mentee pairs in the Montpellier mentoring program increased from 15 in 2015 to 50 in 2018 and ever since through 2021. In Toulouse the number of mentor–mentee pairs has deliberately been maintained under ten. In Paris-Saclay the program was launched with 9 mentors in 2018 and increased to 43 and 44 in 2019 and

2020, respectively. Most mentors were affiliated to CNRS, France's national scientific research institution, followed by INSERM, universities and INRAE.

Mentees commit to meet their mentor on a regular basis and to attend collective activities. A minimum of 20 hours is required for validation by the university's doctoral college. Over the past two years, PhD students from a variety of scientific disciplines enrolled in the mentoring programs, including students from chemistry, physics, mathematics, economics and political science, biology (biochemistry, life and health sciences), environmental science-ecology and agronomy. The program was most successful with PhD students in their first and second year, but students in their third and fourth year as well as several postdocs also attended.

Mentor–mentee matching and establishment of a trusting relationship

The spirit of the program is based on the assumption that open discussions and transfer of experience are facilitated by a caring and trustworthy climate. To favour freedom of speech, preserve the confidentiality of discussions and limit conflicts of interest, matched mentors and mentees should belong to different research institutes. Moreover, to prompt mentor–mentee pairing based on human affinity, the program organizes 'speed-meeting' sessions during which each mentee gets to meet different mentors. Mentors briefly describe their career path, personal and professional experience and motivation to participate in the program, and mentees describe their career aims and interests which have led them to enroll in the program, such as seeking advice from female scientists, integrating a female professional network, gaining self-confidence and finding support when encountering difficulties that cannot be addressed alone. The mentees then select their top three mentor choices. It is not uncommon for mentees to choose a mentor from the same cultural background. Some mentees choose mentors from the private sector so they can gain insight into an unfamiliar world. Some mentees prefer to be mentored by male mentors, as they believe the career planning strategies differ from those of women and wish to learn from such perspectives. Some mentees feel more comfortable with mentors from the same field of expertise as theirs. However, many mentees choose mentors with a different scientific background from their own. Mentors are matched to mentees by the steering board in order to accommodate all requests as well as possible, and all participants are required to sign the mentoring charter.

Although mentor–mentee pairs are formed based on affinity, a trusting relationship will build up over time and through regular meetings that take place in a confidential and constructive climate. During the first couple of meetings, mentor and mentee have to get to know each other and define issues, needs and objectives. The mentor should make the mentee feel comfortable enough to

start confiding and will then be able to help her reflect on appropriate choices and perspectives to balance personal life with professional development. Meetings are usually face-to-face although in cases of lengthy travelling of either the mentor or the mentee or confinement due to the COVID-19 situation, video conference meetings can also be scheduled.

Feedback and follow-up during and beyond the program.

Mentor and mentee pairs are asked to complete a follow-up sheet for each meeting indicating the date, duration and a brief description of the content of the discussion. The content of these monthly meetings are analyzed anonymously to assess the overall content of discussions, reflecting issues that mentees need to discuss with their mentors (**Fig 3a**). At the end of the program, mentees and mentors fill out an evaluation survey in which they are asked to mark the utility and quality of the different training sessions, mentoring circles and presentations of female scientists. They are also asked to make suggestions to enable the steering committee to adjust and improve the program (**Fig. 3b**).

The 12-month program concludes with a testimonials evening, during which mentors and mentees are invited to describe and share their experience with other mentors and mentees from the same program and with the next generation of mentors and mentees-to be who wish to enroll in the next program. Keywords that the mentees associate with the mentoring program convey positive and constructive feelings indicative of the nurturing and trustworthy yet stimulating environment the mentors succeed in establishing, as well as notions associated with fulfilment, opportunity, solidarity, networking and professionalism.

Mentees are also asked if they wish to join the network of alumnae –now a professional network of scientific contacts but also a source of future mentors once they have made progress in their careers. Mentees are contacted every year to follow up on their professional status and career paths. Since 2015, following their PhD the majority of mentees from the Montpellier program have secured positions in academia or in the private sector, indicating the program's positive influence (**Fig. 3c**).

COVID-associated adaptation

COVID-associated measures such as lockdowns and social distancing brought many restrictions to the original program, which relies strongly on human contact and discussion. Faced with these restrictions we chose to adapt the program by avoiding physical group meetings and workshops and moving them online. The nature and frequency of mentor/mentee meetings also varied, with time, work and personal constraints causing some mentors to become less available or mentees having

greater need of support. At the turn of 2020, training sessions for new mentors and mentees-to-be have so far been scheduled through virtual platforms.

Outcome and perspectives

The mentoring program established by Femmes & Sciences was designed to meet a specific need for guidance of female PhD students in their career path development, to help them gain confidence and nurture their ability to value their skills. The spirit of this program is intended as caring and constructive, dynamic and stimulating, in a trustworthy and professional environment. Beyond the content of the program itself, three levels of networking were observed: first, between mentors and mentees; second, among mentees from different scientific fields who developed personal and professional solidarity throughout the different group meetings and training sessions they attended; and third, between mentors who developed new interactions through common objectives with colleagues from different research institutes and organizations. Moreover, beyond the qualitative training aspects, the program prompted greater open-mindedness in most mentees by broadening their career perspectives and providing them with tools and strategies to achieve their professional goals. The participation of male mentors in the program (although less than 10% of all mentors) constituted an important contribution, as they provided a different perspective which was considered with interest by several mentees, as well as a strong implication to support women in their scientific career.. Last but not least, many mentor–mentee pairs developed a relationship persisting well after the end of the program, contributing to establish intergenerational networks between women in science.

Once the pioneering program was established in Montpellier, Femmes & Sciences organized its annual meeting on this theme. The 2017 Femmes & Sciences Meeting⁷ was a culmination that earned the program ~~in gaining~~ formal recognition and support ~~of the program~~ by French institutions, including Montpellier University, CNRS, INSERM, INRAE and IRD. The short-term outcome is the successful professional insertion of young women with a PhD who develop a more assertive approach to the construction of their career path. In the longer term it will increase the proportion of female scientists with a PhD in academic positions as well as in the private sector. As such, the success of the program at the Universities of Montpellier, Toulouse and Paris-Saclay has prompted the Ministry of Higher Education, Research and Innovation to ask Femmes & Sciences help bring the program to several other French universities.

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FIGURE LEGENDS

Figure 1 | Proportion of female researchers in France and in 24 Organization for Economic Co-operation and Development (OECD) countries.

Figure 2 | Structure and content of the mentoring program. a, Three-faceted content of the mentoring Program. **b,** Sequence of events/different meetings proposed throughout the year (Montpellier, 2019).

Figure 3 | Evaluation and follow-up of the mentoring program. a, Main topics of discussion between mentors and mentees during one-on-one meetings based on follow-up sheets from Montpellier in 2019. **b,** Evaluation of the different aspects of the mentoring program by mentees of Montpellier Mentoring Program 2019. **c,** Career positions after their PhD defense of the mentees who attended the Montpellier mentoring program between 2015 and 2019.