For a sector at the cutting edge of scientific progress, it is surprising that equally forward-looking policies to ensure female scientists’ development, retention and progression have not been successfully implemented. *International Innovation* explores this issue in a roundtable discussion with key contributors from this edition.
Q: What are the main barriers facing women in science? How can universities, research institutions and industry attract and retain more women in these disciplines?

**DR MEREDITH S BERRY**  
University of Montana, USA

A significant barrier is the lack of visible role models and institutional support. Organisations could design a built-in infrastructure that increases visibility of successful women role models and provides information or workshops on how to overcome challenges faced by women in science (e.g. discrimination, sexual harassment, potentially elevated financial or childcare burden).

Stereotyping of women’s career options and fulfilling teachers’ expectations of gender differences between men and women is also a problem. It would be ideal to develop a training programme for teachers of all levels to increase awareness of the effect of stereotyping on children and adult learning.

Another difficulty lies in a lack of financial independence to pursue higher education. Wherever possible, merit- and need-based scholarships should be offered to women in STEM fields, as well as internship opportunities. We need to eliminate income inequality within organisations and speak out against the gender gap in income publicly.

**DR SYLVIA E MCLAIN**  
University of Oxford, UK

This is a question we have been asking ourselves since the 1970s, but clearly it isn’t improving very quickly. Fundamentally, these issues are not very straightforward to address as I believe they are largely about culture and unconscious bias.

I think there should be much more emphasis on departments, institutions, etc., focusing on what their particular problems are with respect to diversity and trying to actively solve them. It is often easy to say ‘women don’t apply’ and leave it at that. If women don’t apply, then actively seek women out to apply – this would be a much better solution than just passively waiting for a change.

**PROFESSOR ANGELA VINCENT**  
University of Oxford, UK

My most significant barrier in my career relates to my ongoing efforts to successfully balance academic research with raising, along with my husband, our two children, currently aged seven and five. The time in which I was establishing a productive and successful research programme coincided with starting our family, making work-family balance my biggest challenge to date.

To attract and retain more women in science, there needs to be increased understanding and recognition of the time and commitment to home life and raising a family. The ability to have somewhat flexible work hours and to work from home are critical factors that allow me to balance family and work commitments on a daily basis.

**ASSOCIATE PROFESSOR LINDSAY ROBINSON**  
University of Guelph, Canada

A major barrier in my view is the lack of women in positions where they can support and promote younger women – one token woman is not enough. It is important that the institutions and committees that run them realise that women should not only be represented on all committees, but there should be at least two or preferably three women, and they should not just act like men, but bring a different perspective to the table. These women should be listened to because their attitudes and views can add to the decision-making process, and may even, over time, gently modify male attitudes!
I hate to speak of barriers because the word makes it sound like it’s impossible to move forward. Certainly there are difficulties along the path to a successful career in science. No doubt men also recognise difficulties, but the difference for women is one of a minority, just as other minorities or underrepresented groups feel within a structure shaped and run by the majority group.

Learning to fit in and succeed in a profession depends on one’s ability to understand and adapt to the culture of that profession. Unfortunately for women, that culture has been shaped exclusively by generations of males, and adapting to it is not straightforward: it’s foreign to us and we are not particularly welcome. Adapting to a male model does not work: women are perceived differently than men in society and adopting male methods tends to isolate women even more. Staying true to their female ways, however, is not always seen as serious or scientific. Furthermore, male scientists in particular seem to be, on average, less open to changing the culture or changing their standards, which they see as rooted in ‘the scientific truth’, when in fact, as has been shown in the literature, they are rife with bias, conscious or unconscious. What makes a good scientific talk? What makes a good teacher? How do you manage graduate students? Should you publish as a single author or in a collaborative team? How important was your part on that team? All these ‘truths’ are up for discussion, but in some departments there is no discussion.

What universities, research institutions and industry can do is to work towards a more open discussion of accepting diverse approaches to scientific work and to broaden diversity within their work groups. In attaining a critical mass, the conversations and recognition of diverse approaches will start to change and allow more women and minorities to fully contribute to the scientific enterprise. The richness of those results will be amazing.

I think the main barrier facing women trying to establish a career in science is the need to return to full-time research as soon as possible after having children. Science is not a part-time career, and it is not a career that can be put on hold for too long given the rate of technological and conceptual advances. Furthermore, parental responsibilities extend beyond infants to include children who are of school age – so even when a woman has returned to work following maternity leave, there will still be additional demands on her time that need to be managed.

In addition to implementing flexible hours for working mothers and family-friendly meeting times (eg. between 9.15 am and 4.30 pm), fellowships to support the return of females to the workplace following maternity leave would be helpful. The provision of technical support to female early-career researchers while on maternity leave to facilitate research productivity in that critical career stage would probably be invaluable.

I have seen so many women leave science to start families and not return; and I can understand this and sympathise since I am a mother. The long hours and dedication required do not always lead to an easy work-life balance, and the cost of childcare and emotional strain put on mothers is difficult to reconcile at times.

I was keen to return to work as soon as possible after taking maternity leave as I was scared I would lose my passion for science. However, I returned after three months even more driven than before. Although this was difficult, tiring and a steep learning curve, the support I received from Keele University made this a smooth transition. I believe the key to being a successful working mum is to have a supportive institution with line management who understand and are flexible to the demanding role of parenthood.
In my field of neuroscience, women actually comprise the majority of PhDs. However, women’s representation in the field declines at every career transition. This is particularly evident in US academic institutions, where only approximately a quarter of full professors are women. So what appears to be happening is that we have a leaking pipeline.

Places of employment can surely do more to help recruit and retain excellent female scientists. First, they can educate both men and women about implicit or unconscious gender bias, which has been empirically demonstrated to adversely affect women when it comes to initial appointments and promotions. Next, they can actively recruit women into tenure-track positions and provide effective mentoring. Mentoring of junior faculty of both sexes leads to greater professional success. Finally, it is a reality that there never seems to be a good time for a female scientist to have a child. More family-friendly policies and affordable onsite childcare services for trainees and faculty alike can help. Academic institutions could implement automatic tenure extension (stop the clock) policies for new parents of either sex who are on the tenure track, thereby removing the stigma that some females feel about taking it. Society as a whole could help all working families by adjusting school schedules to match work schedules.

On a more personal note, women must choose their partners wisely. Having a life partner that is willing and able to support one’s professional choices, to shoulder home and childcare duties proportionally, if not disproportionally, and understands and doesn’t fully lament the long hours it takes to have a career in science – or in any discipline for that matter – is key to success.

As a woman clinician-scientist, I have experienced considerable change during my career that has allowed women to be productive members of the scientific community. Working with a group of paediatricians who value research has allowed me to follow my vision.

Some of the barriers I see that impact the success of women in science include the lack of adequate training and rigid schedules that are inflexible to the lifestyle issues that women in particular have if they choose both a career and family. Universities that lack onsite day-care facilities do a disservice to women and men alike who are pursuing careers in science. Ancillary support services to assist young investigators to receive grant support may be sporadic or less suited to certain avenues of STEM.

One approach to ensuring women continue to participate in scientific disciplines is to facilitate the building of a multidisciplinary team, which allows greater depth and vision that translates into better science. I have benefited enormously from the team that surrounds me. It truly takes a village to be a successful scientist and having the opportunity to collaborate across scientific disciplines provides the necessary platform to achieve this.

This is a difficult question to answer as I do not believe that the barriers are easily defined. My feeling is that a part of the answer as to why less women than men enter STEM careers starts with how girls are generally socialised to be less curious than boys. They are not encouraged to spend hours observing and wondering about the behaviour of ants or to figure out how a vacuum cleaner works – they should rather learn how to use it.

This points to fundamental issues in society that ultimately lead to certain careers, including STEM, still being viewed as ‘man’s work’, while other areas are dominated by women. As such, there are easy interventions that could be applied to immediately change this situation. One possible way is to increase the visibility of female scientists as positive role models in society.
The main barrier facing women in science is sometimes women. The ‘imposter syndrome’ is a trait that many women carry – the fear of not being good enough, not going for that promotion, not asking for a pay rise.

Universities, research institutions and industry could retain more women if they supported women with mentorship programmes. I believe our challenge is to have the courage to be more like ourselves than anyone else and play to our strengths. We need to be clear about what we stand for, and allow our research and evidence to inform our practice.

In my case, my vision for the future was realised by following my passion. I know the future I want to create and I can see a number of possible ways to achieve this. My research can speak volumes in a congress or seminar on the world stage. In the future, my hope is that there will be no need to label ‘female’ leaders, there will just be leaders.

I believe increasing the number of women in science will require a multipronged approach. Messaging starts early and can have a large impact on women. The media has been shown to change people’s perceptions for other causes. Positively depicting women and girls with STEM interests and careers in movies, television and stories may be helpful. The burgeoning market for toys that encourage building and mathematics for girls could also prove fruitful.

Furthermore, primary and secondary education could create curricula that highlight successful women and role models in STEM careers.

In terms of institutions attracting and retaining more women in these disciplines, transparency may be important. For instance, publishing the admission rates to universities and the hiring rates of women at all levels in an organisation may provide some accountability and competition to improve the percentages. To counteract potential unconscious biases, universities and organisations could accept blinded application policies. Furthermore, salaries and expectations for advancement could also be made transparent. Finally, allowing flexible schedules for women with children would allow them to stay in the workforce and work around their family needs. Women should not be penalised for attempting to have a work-life balance.

I think one of our advisory committee members, Sharon Vosmek of Astia said it best: “Stop fixing, mentoring and supporting women – just invest in them”. I think this is the key. Once women and underrepresented minorities have opportunities, we rise to the occasion. For me, the creation of 21st Century talent is one of the most important things in the world. We need all our talent to solve the complex and critical problems that we face. Diversity of all types brings new perspectives – these perspectives are vital for providing change and tackling complexity.