She Talks Science

MAY 2017

Murray Edwards College
University of Cambridge

Providing opportunities
for young women of all backgrounds

'Talk and tea' with Maths students

She Talks Science

at Murray Edwards College

For young women with the insight to question and the imagination to find answers.

Murray Edwards College has a proud history of providing opportunities for young women. New initiatives are introduced in response to changing expectations, changing issues and improved understanding.

The 'She Talks Science' initiative was established in response to concerns about the flow of young women into the study of some science subjects and subsequently into professional roles in science. Murray Edwards wants to ensure that young women from all backgrounds are able to make the most of the opportunities in science at Cambridge. The first step in accessing an opportunity involves the choice of aspiring towards it. The provision of accurate and appropriate information is key to this choice. In addition we need to work effectively with the complex range of influences which impact on the decision-making of young women.

'She Talks Science' is grounded in our understanding of how young female scientists view themselves and their futures. It facilitates informed decision-making and positive engagement with science. The activities complement the support and resources that already exist through Directors of Studies, academic departments and other professional organisations and through the many committed teachers of science within our schools.

Front cover image: *Dr Zoe Wilson, Fellow in Chemistry at Murray Edwards College*

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01 Why choices about science matter

Student helpers offer a warm welcome

Optimising the contribution of women

As a College for women, our role is to provide opportunities for outstanding young women of all backgrounds. We provide the opportunity for high level study and we facilitate the opportunity to progress to rewarding graduate roles in the professional world. For this reason we want to understand where and why young women of high intellectual capability may be under-represented in certain subject areas in our universities and in society.

The under-representation of women in some areas of science and technology is well known (see section 'Choosing Science: what we know'). The concern arising from this is two-fold. Firstly from the perspective of the individual: are young women losing the opportunity to study science/technology subjects in which they may have (or could still develop) passion and ability? Secondly, is society losing the contribution that very capable young women might be making within the fields of science and technology? As a consequence, are women sufficiently represented in these areas and do women reach the seniority of contribution that their ability justifies?

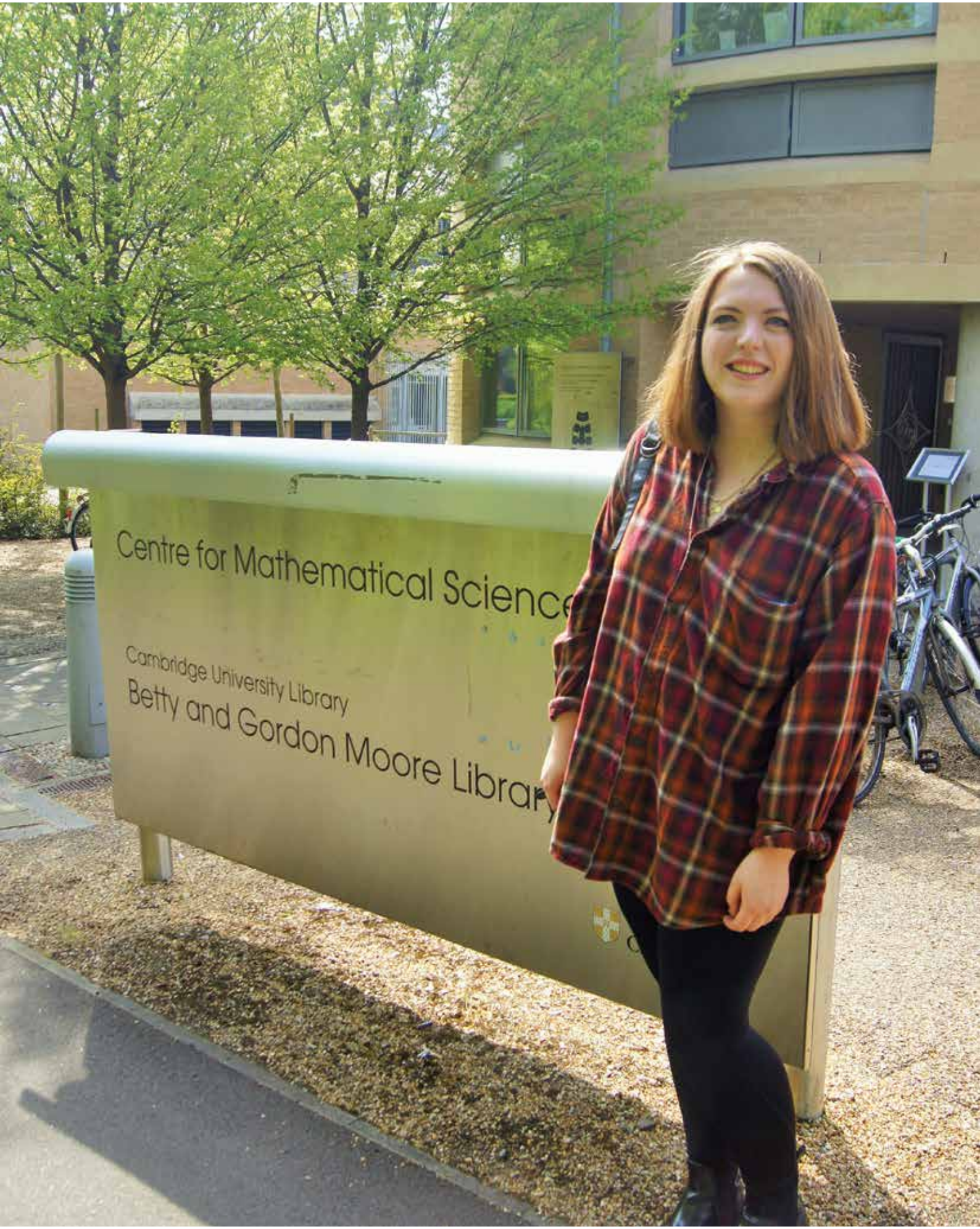
Optimising the application of scientific training

Women are under-represented in certain professional fields within science, eg engineering and technology. This under-representation is very real and very serious but it perhaps masks a much bigger problem ie the under-representation of scientific skills that may arise across a wide range of careers and more broadly in society if the pool of those with scientific training is too shallow.

Scientific training equips young women (and young men) with a wide range of important skills including the ability to:

- Manipulate numerical data;
- Interpret trends and graphs;
- Understand the limits of statistical data and its interpretation;
- Review the balance of evidence;
- Take a systematic and analytical approach to problem-solving;
- Comprehend and apply basic scientific principles relevant to many areas of health, industrial development, transport, energy and agriculture.

These skills are not confined solely to those who have studied science or technology but they are developed, practised and strengthened within science-based courses.



Undergraduate student in Maths

02 Choosing science – what we know

Research as a Cambridge undergraduate

The pipeline into science

Concerns about the 'pipeline' of women in science and technology have been expressed for several years by WISE (Women in Science, Technology and Engineering) and others. The problem is particularly acute in the UK but is also evident internationally. Research demonstrates that while there is good representation of young women within the biological and medical sciences, they are significantly under-represented in STEM subjects (Science, Technology, Engineering and Maths). For the UK, we know that:

- Only 21% of Physics 'A' level entrants were female (WISE, 2014b).
- 86% of those completing Engineering and Technology degrees are male (WISE, 2014b).
- Only one in 10 STEM managers are female (WISE, 2014b).
- Since 2014 the proportion of women in science professional occupations has fallen from 50% to 41% (WISE, 2016).
- The UK has the lowest percentage of engineering professionals in Europe (Women's Engineering Society).
- The proportion of women accepted to study sciences within the University of Cambridge from the 2014/15 application round were: Maths 15%, Computer Science 18%, Engineering 27%, Natural Sciences 40%.

Though less extreme, the problem extends beyond the UK:

- In the National University of Singapore 27% of those studying chemical and electrical engineering are women.
- In India approximately 33% of those on engineering courses were female although the proportion of women in the 'top' educational institutions was substantially lower (Aggarwal, 2013).

Conversely we know that women have the capacity to achieve highly in relevant disciplines; in 2014 female students in the UK had a higher A* to C pass rate than male students at A-level in both Maths and Physics (WISE 2014b).

> “… stereotypes of the physical sciences being male dominated and men being better at maths, were definitely a discouraging factor for girls choosing their A levels [at my school] – an age when we are also particularly susceptible to social/peer pressure.”
>
> **Current undergraduate student**

Research Insights

We also reviewed research on factors that influence the choices about engagement in science that young women make. These factors include:

Identification

A sense of identification with those already working in science is important if girls and young women are to maintain their interests. This is the central message in the WISE report ‘Not for people like me’ (2014a). Lack of identification with science starts at a young age and is very pervasive. For example, Chang et al (2011) showed that mothers talked significantly more to their toddler age sons about cardinal numbers than their daughters and Long et al (2010) found that male scientists significantly outnumbered female scientists in popular TV programmes viewed by 12–14 year olds (in the USA). Consequently, as a Higher Education Institution working primarily with 16–21 year olds we are working in a setting within which concerns and misconceptions are likely to be well-embedded.

Stereotype threat

Stereotype threat arises when girls and women absorb wider societal assumptions about the relationship between gender and performance/preferences, thereby either consciously or non-consciously associating the choice of science and high achievement in science with being male. This can affect their confidence as well as the choices that they make. It can also lead to a measurable detrimental effect on their own performance (Good et al, 2007; Galdi et al, 2014). It is important to recognise that those affected by this influence are often not conscious of the impact, having deeply absorbed and accepted the norms to which they are responding.

Implicit bias

While stereotype threat relates to the ways the performance and choices of girls/women themselves are influenced, implicit bias is a factor which has been shown to influence the judgements made about women (and girls) by others, both men and women. We may judge differently the abilities of a man and a woman, presented to us identically on paper, simply on the basis of the perceived gender of the name (Moss-Racusin et al, 2012). This disadvantages women in the sciences and is likely to mean that they are offered fewer openings and are less able to progress than their male colleagues.

Innate ability

Research has shown that high achieving girls differ from high achieving boys in their response to confusion arising from demanding concepts. High achieving boys are excited and motivated by the difficulty, high achieving girls are demotivated and lose effectiveness, (Dweck, 2006). This appears to relate to the concept of ‘innate ability’. Women (and girls) are more likely to associate success in demanding subjects (like maths) with a ‘gift’ or ‘innate talent’. As such they often believe that any set-backs reflect deficiencies in their own fundamental ability and are therefore not resolvable. Boys are more likely to see such set-backs as a stimulating element of the learning process and indicative of skills they can develop.

It is interesting to note that in the UK young women are 2.5 times more likely to choose to study physics in single sex schools (Institute of Physics, 2012). One may deduce that in such circumstances they will be exposed to female peers excelling within science and often to strong female role models through their teachers. It is likely that their sense of identification with the science community will be stronger, and the influence of stereotype threat and implicit bias reduced.

03 Developments within Murray Edwards College

School students sharing ideas at our 'Women in Science' Symposium

'Women in Science' Symposium

In September 2014 we organised a 'Women in Science' Symposium to review what is known both about the pipeline and about practical actions to address any deficiencies. We deliberately included participants from a range of relevant groups from students studying sciences in school, through teachers, to science graduates, employers and those involved in educational research and policy. The event confirmed that our knowledge is growing rapidly through the excellent work undertaken by many groups and organisations active in this area eg the Institute of Physics (http://www.iop.org/) and Women in Science, Technology & Engineering (https://www.wisecampaign.org.uk/).

College President leads discussion about the pipeline into science

Several recommendations arose from the symposium including:

- Improve the numbers, range and visibility of female role models in science;
- Be aware of the importance of confidence and resilience;
- Encourage a sharing of best practice.

Further development

Since the symposium we have introduced further developments. While we are very aware from the data that the number of women choosing to enter physics, maths and engineering is a particular issue we are also concerned to provide support to young women across the full range of sciences to ensure that their progress into roles in science and into senior positions in science is enabled.

> “Discovering that Dame Jocelyn Bell Burnell, who first detected radio pulsars, attended Murray Edwards is a huge motivation for me. It will be incredible to study and live at the same college as such a brilliant woman as her.”
>
> **Prospective undergraduate student**

We ground what we do in research evidence and in known good practice. We set out to improve the positive associations between women and science through use of role models as mentors, as exemplars of achievement and as representatives of a wide range of careers (Murphy et al, 2007; Cundiff, 2013). In addition we encourage young women to articulate their scientific interests, to share their ‘voice’ with peers and to feel proud in what they are achieving, thereby increasing their confidence and intellectual resilience (Institute of Physics, 2012; Robnett, 2012).

We have:

- Established She Talks Science – our blog and one day conference;
- Strengthened our understanding of the student perspective on ‘science’ careers;
- Re-visited how we can enhance support for young women studying science within Murray Edwards;
- Begun sharing what we learn to encourage further debate (eg through publications such as this).

Expert panel responds to questions at our ‘Women in Science’ Symposium

04 She Talks Science: blog and conference

Welcoming school students to a College event

Objectives and content

We set up a 'She Talks Science' blog (shetalksscience.com) in order to give young women interested in science a voice and to show them how other women are already contributing to science within roles that excite and challenge them. The blog has been running successfully for 20 months and has already secured over 25,000 hits.

The blog is based on a 4 week cycle with one item a week uploaded during school terms. All contributors are women.

Cycle week A: An item from a woman scientist about her work and its interest.

Cycle week B: An item about some aspect of science: current news, interesting research questions etc.

Cycle week C: An item from a school student in year 11 or 12 who has contributed a winning item (see below) to 'She talks science' about something science-related.

Cycle week D: An item from a current Murray Edwards student about her studies (in a science subject) at the University of Cambridge.

School entries

Each school item is based on a competition. Schools volunteer to take part, run the simple competition and then send the winning entry through to us for inclusion on the blog. We leave the choice of topic (within science) open to the schools and students because we want to encourage students to express their curiosity wherever it might lie. We direct the opportunity primarily at state schools although we are happy to accept the involvement of independent schools where they agree to work in tandem with a partner state school (and provide a winning entry from both schools).

Schools enjoy participating and find it both motivating for students and easy to run. The winning student receives a 'She Talks Science' hoodie which enables her to promote the 'She Talks Science' concept further within her local community and to celebrate her achievement.

"She Talks Science was a great opportunity to pursue an area of interest not studied at school, and I'm proud to have had my entry on the blog alongside other women who are studying or working in STEMM. As I've worn my hoodie around, quite a few people have asked me what the She Talks Science project is all about, and this has given me the chance to spread awareness of the project, and the importance of this project at the start of my career as a female scientist."
Isi Moss (Landau Forte College)

> “Above all girls need to be able to self-identify that ‘STEM is for people like me.”
> **(WISE 2014a)**

One school noted that it generated interest in science beyond the science students. This is of course particularly encouraging as it is indicative of the acceptability of science interests to a wider peer community.

> *“We have our winning entry – the girls, even the non-scientists, really engaged with it and were very creative with their submissions!”*
> **State school teacher**

‘She Talks Science: Aiming High’ conference

Following the interest in the blog we introduced a ‘She Talks Science: Aiming High’ conference. Its aim was similar to that of the blog, ie to inspire and encourage young women with their interest in science and to inform them about the range of opportunities to which this might lead. Through the stories of successful women scientists, participating students were encouraged to consider what they might want to achieve, without restricting their choices and expectations through any self-limiting reticence. Presenters and student peer guides were almost all female to encourage identification with a relevant (female) community of scientists. We anticipate that in addition to the immediate benefits of working with role models and peers it may also contribute at a more subconscious level too, countering any assumed expectation that women will usually achieve less in certain science subjects (STEM subjects) than male counterparts (Blickenstaff, 2005).

The day was attended by around 50 students and warmly received. Student participants reported that they took away understanding about:

- The wide range of science courses available;
- The wide range of career options open to those with a degree in science;
- The acceptability of aiming high and taking academic risks.

After the formal sessions had ended we encouraged those participating to talk to us informally about their experience of the day. These students were very positive and highlighted two slides as particularly thought-provoking. These slides were: range of undergraduate degree courses in science and range of graduate jobs (consistent with the structured feedback described above). Two students commented that they had been considering dropping science because they did not want to work in a lab or become a teacher, now that they saw so many more possibilities they were re-considering. These observations led us to re-visit our understanding of the student perspective on careers (see section ‘Careers in Science – the student perspective’).

> *“It has inspired me to pursue a career in science and has motivated me to work hard in order to apply for a prestigious university.”*
> **Visiting school student**

She Talks Science: voices

shetalksscience.com excerpts: A selection of winning entries from schools

The three pages which follow show excerpts from some of the entries on our blog. The first two pages show a selection of the items from participating schools and the third page shows a selection from the items about career paths, current research questions and undergraduate studies. The latter exemplifies the broad range of sciences covered and in which women are engaging with success and passion. Perhaps not surprisingly many of the entries from school students focussed on the biological and medical sciences. However, by engaging with the blog we hope that young female scientists will become more aware of the breadth of science opportunities available including those they may not previously have considered.

How a virus outplayed the military

Sadiyah Zaman (Newham Collegiate 6th form centre)

…But how did the Europeans exactly colonise America? What were their tactics? You may be thinking it was due to the help of the Conquistadors or the advanced weaponry. But something much smaller, in fact microscopic, helped Europe colonise America: the Variola virus. When the Europeans travelled to America, they transmitted a virus which was foreign to the Native Americans. Why was this virus so significant? This virus caused a disease called small pox; a lethal disease that killed thousands of Native Americans and ultimately helped the Europeans colonise America …

I wrote this article because I have a passion for health care and I'm fascinated by diseases, the human anatomy and medicine.

The chemistry of tea

Isi Moss (Landau Forte College)

Who doesn't like a cup of tea? 6.2 billion cups of tea are consumed in the UK every year, proof that tea is Britain's most loved beverage. But what's the chemistry behind a brew, and what is it that makes tea so special?

… As well as caffeine… there are also other compounds in tea which are less well known, such as polyphenols, which are responsible for much of the taste as well as the characteristic colour of black tea..

Surprisingly, there are 180-240mg of polyphenols in a strong mug of tea, and these compounds make up approximately one third of the weight of dried tea leaves …

I would love to be a Science Journalist, communicating my passion with others, and working towards putting Chemistry in the spotlight of public interest, alongside the other popular sciences.

Why does the earth hum

Ankita Hajra (Lancaster Girls' Grammar School)

In the 1990s, doctors at Addenbrooke's Hospital in Cambridge blamed patients being able to hear the hum on tinnitus until someone confirmed that the cause was an external factor. The hum is said to be heard more prominently when indoors and during the night and many people describe the sound as "a diesel car idling in the distance." The hum has also been felt in many other parts of the world such as in New Zealand, America and Australia.

So, what causes the hum? …

I have always been very interested in science, especially in the human anatomy and the science behind natural phenomenon so writing an entry for the blog was perfect for me.

The intricacy of our universe

Molly Haigh (Maidstone Grammar School for Girls)

… As science progresses with the discovery of new constraints and laws, it's becoming much harder to cope with the intricacy of our universe as we know it. As I see it, our universe is a very complex entity and no one person could retain knowledge about its entirety. So, do our brains, a product of this universe, have the capacity to understand it?

There are many setbacks concerning our understanding of the universe, especially the conflict between highly regarded theories and laws that govern its existence. For example, one problem encountered is the fact that we cannot combine Einstein's Theory of Relativity with the more modern Quantum Theory …

I have always had an interest in Astrophysics, …There are still many interesting unanswered questions regarding this subject, which is one of the reasons why I hope to study this exciting branch of physics at University.

Why eat chocolate?

Georgia Bohan (Wirral Grammar School for Girls)

As a nation Great Britain is one of the highest consumers of chocolate in the world. On average a British person consumes 11kg of chocolate each year, the equivalent of three bars a week; so why do we eat so much chocolate?

As well as its sweet taste and creamy texture, chocolate contains a compound called theobromine which is thought to be another contributing factor to chocolates popularity. Theobromine is a fairly simple organic compound with the formula $C_7H_8N_4O_2$, it is a bitter tasting alkaloid and comes from the cocoa plant. Theobromine has some similar effects on the body as caffeine, since the two substances have an extremely similar structure. For example theobromine can reduce tiredness and increase alertness. It is also a cough suppressant and can help reduce the symptoms of asthma …

I am currently studying Chemistry, Maths and French A Levels… Next year I am hoping to study Chemistry at University.

Humans and perception

Emily Hockham (Queen Elizabeth's Grammar School, Horncastle)

Essentially everyone has their own reality. Everyone has their own little world with thousands of things different to the person stood next to them. Say for example there were fifty things going on at every given moment around every person on the planet, and we observe maybe 30 of these at every given moment; any slight change to the world around us. Well those thirty things that you witness and subconsciously notice are going to be different to the thirty I witness …

… Your green is different to my green, your red is different to my red and so on. To combat this, we have somehow come up with a standard colour that everyone is apparently seeing to categorise the parts of the visible light spectrum that are reflected by different surfaces …

In the future I would like to train to be a surgeon.

shetalksscience.com excerpts:
Careers, research questions and undergraduate studies

CAREER PATH: Understanding dark matter

Sarah Williams – Physics

As a researcher on the ATLAS experiment at the Large Hadron Collider at CERN, one of the things I love about my job is that on a day-to-day basis I get to interact with scientists from different backgrounds… The ATLAS collaboration includes around 3000 physicists from over 175 institutes around the world, all working together to answer fundamental questions about the elementary particles and interactions in the universe.

My work focuses on searches for new particles at the LHC, and in particular those that could help explain what makes up Dark Matter in the universe. Astrophysicists now believe that dark matter makes up nearly 25% of the mass energy content of the universe… Although we don't currently know what dark matter is made of, there is strong evidence that it could constitute a "weakly interacting massive particle" (or WIMP) which could thus be searched for in the high energy collisions …

SCIENCE QUESTIONS: The extraordinariness of the ordinary

Erica Bithell – Materials Science

I spent a while recently flipping the lid of a cosmetics bottle open and shut. This was the kind of lid that you typically get on shampoo bottles, ketchup, honey and so on, where the bottle top, hinge and lid are all fabricated as a single piece of the same material. This particular one was sealed simply by a stopper on the inside of the lid popping securely into a hole on the bottle top …

Try to find one of these lids yourself, and take a careful look at it, thinking about the properties that are needed to make it work …

I came into Materials Science out of a fascination with materials at the atomic level; the way that atoms organise themselves into the structures, materials and artefacts that we see and use in the world around us …

UNDERGRADUATE STUDY: More women in Engineering

Rachel Attwood – Engineering

In Britain there's an idea that engineering means men, usually wearing muddy boots and hi-vis jackets, maybe working on the side of the road or railway line. It's a very skewed image of one of the fastest growing global industries!

What about the structural engineers who are office based, designing anything from a simple footbridge to a monstrous timber-based skyscraper? What about the electronic and information engineers who design the software for your latest iPhone? …

When I was young it was always 'How does this work?' and 'Why?'. Later on, I took part in a bridge design challenge at secondary school, using rolled up paper tubes to make the strongest structure possible. I later attended two design and build Smallpiece Trust engineering courses (railways and structures).

I set my sights on studying engineering, and where better than at Cambridge …

Visiting College gardens in a She Talks Science winner's hoodie

05 Careers in Science – the student perspective

Computer Science alumna working for a medical charity

When able young women scientists choose not to pursue their interests further it may be either that they are basing this decision on sound information, ie a fully informed alternative choice, or that they are making the decision based on too little information or a misapprehension of the facts. There are indications that the latter may be important and an area where we can expect to make a difference. What is it that students don't know or misapprehend?

Range of opportunity

From our one-day conference we learned that participants were so unaware of the breadth of courses and of career roles in science available that they had not even considered checking these out. In simple terms they believed that if they were interested in Chemistry then they would study Chemistry at university and become a bench chemist or chemistry teacher into the future. They were not aware that it would be possible to choose a degree in 'Medicinal Chemistry', 'Chemical Engineering', or 'Chemistry and Forensics' or a career role in pharmacovigilance or in scientific communication for a medical charity. This observation is consistent with those reported for 10–13 year old schools students (Archer et al, 2014).

> *"When I was at school, STEM degrees were always promoted as leading directly into one specific career path, and unless by the age of 16 you were sure you wanted to become a research scientist, many students were put off taking STEM A levels and hence prevented from picking STEM degrees."*
> **Current undergraduate**

The nature of roles in science

Research throws some light on what women seek and value in career roles.

Diekman et al (2010) investigated the relationship between gender difference and career goals. They identified two categories of career goals: agenic goals (power, achievement, new experiences) and communal goals (intimacy, affiliation, altruism). They found that women were more drawn to communal goals than men and also importantly that women were less confident than men that communal goals would be fulfilled through the choice of a career in STEM.

The WISE report 'Not for people like me' (2014a) strongly advocates using aptitudinal descriptions to define roles in order to provide greater appeal to young women.

> “Emphasise the values and benefits which girls (and their families) care about.”
> **(WISE 2014a)**

Consistent with the Diekman research it argues that this relates to motivation and ‘reward’; men more often see the rewards as the product while women feel rewarded by the characteristics of the process and the outcomes for others.

In our ‘Aiming High’ conference we presented a list of roles that had been advertised for science graduates during that month and also showed how these might be perceived alongside categories of aptitudes proposed by WISE (see table). As previously noted, participants picked this slide as particularly eye-opening.

We also note that many of the winning blog entries submitted by school students present science in a way that reflects the implications for people; their curiosity has been captured by both the science and by what it means to our lives and our choices.

WISE category	Jobs advertised for graduate scientists (March 2016)	WISE aptitudes
Communicator	• Science Communications Officer • Editorial and Production Assistant	Empathic, good with words, likes to engage with different audiences.
Service Provider	• Environmental Planning Consultant • Radiotherapy physicist	Organised, good attention to detail, likes to deliver what others need.
Investigator	• Data Analyst, Health and Social Care • Analytical Chemist	Logical and cooperative, likes to work in a team gathering ideas and information.
Regulator	• Pharmacovigilance Officer • Electronics Patent Attorney	Honest and fair, likes to ensure that all is done well and safely.
Explorer	• Laser Engineer • Renewable Technology engineer	Intuitive and practical, likes to be the first to know and to understand.
Manager	• Aerospace project co-ordinator	Organised and good motivator, likes to manage resources and time to good effect.

Working *with* science as well as working *in* science

We observe that there is an interesting distinction between roles which involve the direct application of scientific knowledge and techniques (geophysicist, structural engineer, pharmaceutical chemist) and roles which draw on this expertise in a more indirect way. The latter category includes roles which specifically require a science degree; for example, as a data analyst for the health service, an international patent attorney or an editorial assistant for a science journal. However, many more roles which do not require a science degree specify skills which will have been highly developed within the academic study of sciences; for example, as currently advertised, an Energy Adviser for the House of Commons (with the ability to absorb complex and technical information), a Health Programme Research Officer (with the ability to manage development projects including forecasting) and a Technical Developer for the Police Constabulary (with the ability to manage information and analyse data).

However, we note:

- Alumnae who studied science but are no longer working in a role which directly requires scientific knowledge are often slightly uncomfortable about this, conveying a sense of 'not fulfilling' their science training or 'letting down' their scientific mentors.
- Current undergraduates who are studying science but who do not want a career which directly requires scientific knowledge are often quite reticent to come forward, are concerned about the reaction of others (eg parents or college advisers) and are under-informed about their options.
- As mentioned above, those participating in our She Talks Science: Aiming High day were very unfamiliar with the range of options open to them.

We deduce that career roles which require the direct application of scientific knowledge/skill are perceived differently to the much wider range of career roles which benefit from scientific knowledge and approaches but are not conventionally designated as 'scientific or technological roles'.

Perhaps because of societal concern about 'pipeline' we have tended to focus attention on the former. However, our observations suggest that in doing so we may be under-valuing and under-promoting the wider range of science-related skills and roles. The possible negative effects of this are:

- Young women in school drop science before committing to A-level or undergraduate studies because they do not perceive the longer term options as either sufficiently broad or sufficiently attractive.
- Young women at university approach careers too narrowly and with a perception that careers working *with* rather than *in* science are second best.
- Alumnae who studied science but now work *with* rather than *in* science present what they do with some reticence rather than in a way that celebrates science, communicating to others their pride in what a science background is enabling them to achieve.

Graduates from the arts and humanities who take roles not directly connected to their original discipline do not show this same discomfort. It may be that in highlighting the problem of the pipeline into scientific career roles we inadvertently build in expectations about the future with which young women feel uncomfortable and which contrasts significantly with the lack of expectation we impose on those in the arts/humanities.

Recent alumnae contacts (online networking, work-shadowing)	
Direct science ↓ ↓ ↓ ↓ ↓ ↓ ↓ Applied scientific skills	Research zoologist (academia) Hydrogeologist (engineering industry) Specialist in technical systems for fundraising (medical research) Biotech business strategy adviser (consultancy) Campaigns manager (international charity)

Implications for activities within Murray Edwards

We introduce our current students to the wider range of careers open to them via the College Gateway Programme and through activities such as online networking with alumnae, work shadowing placements and internships (see companion booklet 'The Gateway Programme').

As regards Summer internships we negotiate some opportunities for students as a College. Students studying science can use these opportunities to explore a wide range of careers. For example, a mathematician chose to take up an internship role as a political assistant to an MP and a natural scientist chose to undertake an internship role with a local sexual health charity.

> *"My work centred on organising an evening event to celebrate the 30th anniversary [of the organisation]…. The brief was big and the budget small and I was thrown in at the deep end and left to find a venue, caterer, speakers and entertainments and report back every couple of days.*
>
> *The team were incredibly friendly and welcoming and had a wealth of knowledge that was amazing to be able to tap into – in particular their experience about how the understanding of HIV infection and treatment has progressed was fascinating for me as a biologist."*

We also provide access to funding so that students can support themselves (eg with accommodation) while they undertake internships or Summer schools which they have negotiated for themselves.

> *"In July 2014 I used my Gateway Challenges Funding grant to attend the Culham Plasma Physics Summer School, held at the Culham Centre for Fusion Energy (CCFE). The school centred around ten days of plasma physics lectures, with a focus on nuclear fusion, augmented by problem solving classes and tours of labs and machinery. The lectures covered many aspects of plasma physics….. Having never studied any plasma physics before, the first few days of the summer school were particularly intense for me."*

In the near future we will also:

- Reconsider how to present information about opportunities in science to young women studying at GCSE and A level;
- Further develop links between our undergraduate students and our science graduates (now alumnae) who are working in a wide range of roles and sectors;
- Extend our alumnae-mentoring scheme (piloted with those entering Law) to those working in or with science.

Undergraduate student helping at a promotional event during an internship placement

06 Associated developments – supporting science in our teaching

Chemistry alumna undertaking research on collagen proteins

We want to ensure that our own undergraduate students benefit from what we are learning about supporting women in science. We are therefore keen to ensure that:

- We provide strong role models;
- We strengthen confidence and self-belief in the ability to master more challenging concepts;
- We provide advice and contacts for those exploring careers working both in science and with science.

a) Gateway Programme

Our Gateway Programme is described in detail in the companion publication 'The Gateway Programme: providing opportunities for women of all backgrounds'. The Programme has been running for 6 years and facilitates the transition to studying at Cambridge and the transition into a graduate career through a series of evening workshops and practical experiences, such as work-shadowing and college-negotiated internships.

It draws on research evidence to inform and enable and, where appropriate, it recognises the particular needs and issues for young women studying science and technology.

b) Collaborative appointments

It is important that young women see other women succeeding and progressing in their chosen subject. This should strengthen their sense of identity as a female scientist and helps to address any inadvertent association between success as a scientist and being male. Within Cambridge University the number of female academics is very low in some key sciences (notably physics, maths and engineering). In order to help redress this balance and to ensure that young women at Murray Edwards can reap the benefit of working with young women of the highest academic calibre we have developed relationships with departments at the strategic planning level in order to negotiate joint appointments open only to women. This ensures that these role models are available to women studying at the college and more widely to young women studying across the University of Cambridge in these subjects.

> “Going from studying Maths at A level to degree level has been quite a big transition but one that was made a lot smoother with the help of the supervisions system and having a really supportive community at Murray Edwards.”

c) Flying Start

Flying Start was piloted with engineering students in September 2016. It aims to ensure that students joining the course from any background have the confidence, understanding and basic knowledge required to ‘hit the ground running’. All sessions are led predominantly by female academics in a collaborative and mutually supportive style. It encourages the students to feel confident in their approach to the forthcoming course and in the colleagueship of other women in a strongly male environment (less than 30% of undergraduates studying engineering are female).

Sharing progress

We know that many others are also making progress in these areas from organisations such as WISE to commercial organisations and to committed teachers in our schools. As we define our own developments we have found it fruitful to learn from the experience and knowledge of others. This report is written in that same spirit, aiming to share what we do so that we can debate how best to progress further. We look forward to working with you on these and other future developments.

College President visiting Schlumberger

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Chemistry alumna working in drug discovery

08 Our Contributors

She Talks Science and related developments rely on the goodwill and engagement of the many contributors who help us each year. These include a number of alumnae and academic fellows as well as the schools who have helped to bring the blog to life with their enthusiasm and original contributions. The College is grateful to all.

Dr Hilarie Bateman, Gateway Programme/Blog lead and former Admissions Tutor, Murray Edwards College, University of Cambridge.

Our congratulations to the She Talks Science school winners. Up to Easter 2017 these are:

SCHOOL	TITLE	WINNING STUDENT
Boston Grammar School	Teaching the blind to see with sound	Rayna Koshy
Bournemouth School for Girls	Is oxytocin the 'moral molecule'?	Ana Valentina Florea
Christ the King College	Equine therapy	Jasmin Brooks
Dame Alice Owen's School	The secret life of the naked mole rat	Katerina Hutton
George Abbot School	The quantum world	Alice Turnock
Haverstock School	Busy buzzing bees	Amy Kitkanna
Headington School	Do babies need to earn parental love?	Phoebe Clargo
Highgate School	Sugar and alcohol in space	Hannah Duffey
Lancaster Girls' Grammar School	Why does the earth hum?	Ankita Hajra
Landau Forte	The Chemistry of tea	Isi Moss
Maidstone Grammar School for Girls	The intricacy of our universe	Molly Haigh
Marlborough Hill	Why do we find pandas so cute?	Aisha (surname not given)
Newham Collegiate 6th form centre	How a virus outplayed the military The healing power of what we believe	Sadiyah Zaman Nazifa Khanom
Pate's Grammar School	A spiny solution to cleaning our oceans	Jasmine Foister
Queen Elizabeth's Grammar School, Horncastle	Humans and perception	Emily Hockham
Sherborne School for Girls	Machines and the essence of healing	Tiffany Chan
Sutton Coldfield Grammar School for Girls	Nimble fingers and an inferior equilibrium	Joanna Samardzija
The Priory Academy	Saving our bees!	Charlotte Bassett
William Hulmes's Grammar School	What is chemistry?	Larissa Aravantinou
Wirral Grammar Schools for Girls	Why eat chocolate? Science and the EU	Georgia Bohan Caitlin Byrne
Withington Girls' School	Obesity and the 'fat gene'	Radhika Sood

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