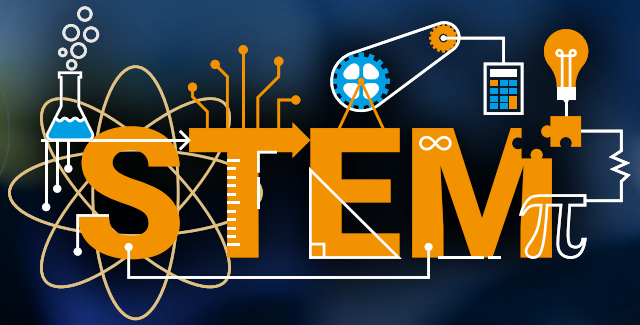




St Mary's School
CAMBRIDGE

Accolade



A focus on STEM
Preschool to Sixth Form

www.stmaryscambridge.co.uk/accolade



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A focus on STEM from Preschool to Sixth Form

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Shaping a bright future in STEM

From Charlotte Avery, Headmistress

We are dedicating this issue of Accolade to STEM (Science, Technology, Engineering and Mathematics) because STEM subjects will play a vital role in our post-pandemic society and women still stand to gain from greater representation in these areas.

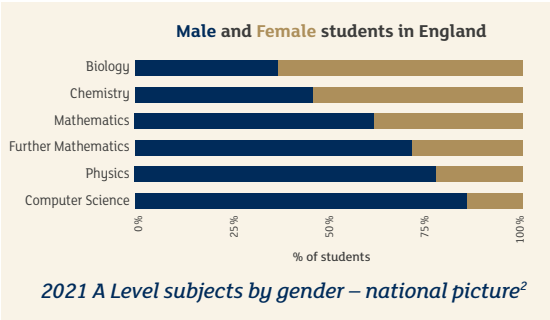
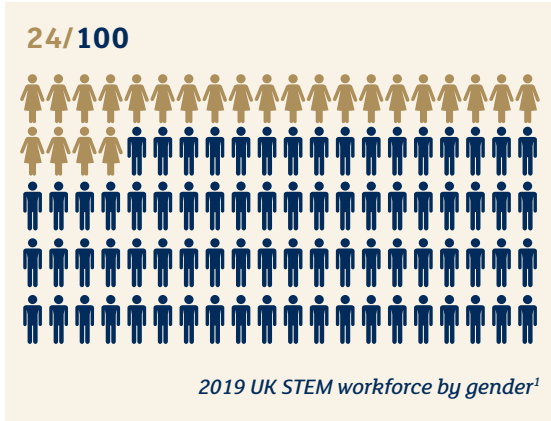


Through Covid-19 the impact of bio-scientists, epidemiologists, vaccine developers, data scientists and medical device engineers has never felt greater.

Women who led the fight against Covid-19 – such as Dame Professor Sarah Gilbert DBE, Professor Catherine Green OBE, and Özlem Türeci – showed a new generation that there are no limits to what women in STEM can achieve. Drawing inspiration from these role models, St Mary's School is empowering young women to become the scientific stars of the future. We have also opened the Yingting Qian STEM Lab at the Junior School this year.

'St Mary's School is empowering young women to become the scientific stars of the future.'

Demand for STEM skills in the UK continues to grow, creating multiple opportunities. Thankfully, government and workforce initiatives to increase the number of women working in this sector are taking effect, and, in 2019, one million women were employed in STEM roles (+350,000 from 2009). Yet, this still only equates to 24% of the entire STEM workforce.



In our schools, girls outperform boys in many STEM subjects at GCSE. However, a gender imbalance persists at A Level, where at a national level significantly fewer girls opt to study Mathematics, Physics or Computing.

As educators, we have a vital role to play in encouraging girls to consider all STEM subjects and the inspiring career paths in this sphere. Indeed, evidence shows that single-sex education effectively challenges negative perceptions of STEM subjects and boosts girls' uptake and performance.³

These issues lie at the heart of our recent drives to promote STEM, including the provisions, successes and plans celebrated in this issue of *Accolade*. At St Mary's, Science and Mathematics have always attracted high uptake at A Level and in the past four years, over a third of our students chose to read STEM-related subjects at university. We don't take this as a given. We work hard to embed a passion for STEM.

To get ahead of the curve, our girls benefit from STEM lessons from Preschool onwards. In Junior School, we unpick assumptions about the sciences and unlock the satisfaction and creativity of STEM subjects. As students progress, Cambridge's thriving tech scene, museums and world-class academic institutes offer positive role models and unparalleled opportunities, from work experience at ARM to inspiring lectures at the University of Cambridge.

Our students, teachers and staff are shaping the future STEM landscape. I couldn't be prouder of them, and I hope you enjoy reading about their achievements.

Sources

- 1. <https://www.wisecampaign.org.uk/statistics/2019-workforce-statistics-one-million-women-in-stem-in-the-uk/>
- 2. <https://www.wisecampaign.org.uk/analysis-of-2021-a-level-core-stem-entrants/>
- 3. <https://gsa.uk.com/research/academic-attainment-2021/>

Ahead of the curve

STEM in Preschool and Junior School

Profile: Jo Christian, Head of Preschool and Junior School

As a Physics teacher turned Head, Jo Christian has gained a wealth of experience during her 28-year career in education. Mrs Christian joined St Mary's in September 2021, and we were keen to learn more about how STEM subjects have influenced her career and to explore her exciting plans.



Following the completion of a degree in Environmental Science at the University of Nottingham, Mrs Christian went on to study a Secondary School PGCE in Physics, inspired to address the shortage of teachers in this subject. In her first teaching post at St Aidan's Church of England High School, Lancashire, her love of science education was cemented. She describes her admiration for her colleagues there, and when offered a position as Head of Year 8 within a year, her confidence as a teacher and mentor grew.

'Maths was my favourite throughout school. I just loved it and found I had a natural aptitude. I also took a strong interest in the sciences from the start, building on my Maths interest.'

This was followed by a role as Head of Science at Five Acres School, Gloucestershire, before gaining experience in SEN teaching, management, and university lecturing. Most recently, Mrs Christian undertook the role of Deputy Head at Bedford Prep School, and throughout her career, her passion for STEM education has endured.

Reflecting on her first year at St Mary's, Mrs Christian notes: 'I've been particularly impressed by the facilities for STEM and the brilliant teachers. We're keen that girls do not just learn facts but develop an understanding of scientific processes and learn to think like scientists.'

Mrs Christian's arrival at St Mary's coincided with the opening of the new Yingting Qian STEM Lab, a specialised, cutting-edge workspace which will enable the Junior School STEM team to further enhance their exceptional provision. As Mrs Christian notes, to get ahead of the curve in STEM learning, a positive early experience is critical. Likewise, it's important that girls do not encounter negative stereotypes. Our aim is to reveal the creativity in STEM subjects, to build confidence in trying new things, and learning new skills, and to encourage success in national and international competitions.

At St Mary's, STEM teaching is carefully tailored to different levels of knowledge, and the team uses STEM projects which draw on themes from across the curriculum. Indeed, for Mrs Christian, it is the ability of STEM subjects to deepen our understanding of everything that makes them so appealing and, to quote Albert Einstein: 'The important thing is to never stop questioning.'

Mrs Christian advises all young scientists to challenge themselves to think, read around subjects and to keep trying new things. As well as sharpening mathematics skills, English and other subjects are vital too, as communication skills improve scientific writing and lend it greater impact. Above all, she advises students to 'enjoy it – STEM subjects enrich your understanding of almost everything in the universe and are an essential part of tomorrow's world.'

Mrs Christian is looking forward to leading future STEM sessions, both in the new STEM Lab and at the Senior School.



'STEM subjects enrich your understanding of almost everything in the universe and are an essential part of tomorrow's world.'

Specialist STEM education

Sparking an interest in STEM from day one

Profile: Tessa Shercliff, STEM Coordinator

Tessa Shercliff leads our specialised STEM programme for students aged 3 to 11. She has revolutionised our approach to STEM education, and we were keen to understand how her background galvanised this programme and what makes STEM at St Mary's so special.

Mrs Shercliff has always been passionate about STEM subjects. This early interest fuelled her Engineering studies at the University of Cambridge and her research work at the University of Oxford. She first joined St Mary's as a part-time Physics teacher at the Senior School, where she loved the staff and the students' enthusiasm, and, over time, she has specialised in STEM education for younger children.

Mrs Shercliff's approach tailors STEM teaching to meet the needs of younger students and addresses the later drop-off of girls in STEM subjects, as she explains: 'I was struck by how girls who showed an amazing aptitude for science could become hesitant to take STEM subjects beyond GCSE level. Maths and Physics show the greatest drop-off of female

students, whereas subjects that seem to have greater practical appeal, like Medicine, held students' interest. As this is certainly not due to lack of ability, I came to think that it must be due to how STEM teaching is often approached and delivered.'

This insight resulted in our Preschool and Junior School STEM programme which showcases the practical applications of even the most 'theoretical' sciences. Emphasis is placed on how subjects connect, making lessons more meaningful and allowing the girls to realise the relevance of STEM early on.

STEM lessons focus on solving real-world problems and each class tackles one project per half term. Opposite, Mrs Shercliff outlines a couple of examples to illustrate how our younger students experience STEM learning.

'I've taught the full spectrum of ages, from Preschool to university, but I really belong with small children. Their enthusiasm is so inspiring, as they come to lessons with open minds and curiosity. It's a time when education has a huge impact, providing a key window of opportunity to show students the interest in all their subjects.'

'I was struck by how girls with amazing aptitude for science could become hesitant to take STEM subjects beyond GCSE. As this is certainly not due to lack of ability, I came to think that it must be due to how STEM teaching is often approached and delivered.'



Exploring clean water solutions in Year 5

In Year 5 students learn about Africa, including the significant challenge of providing safe drinking water across the continent. In science, we study materials, mixtures, and material properties in relation to this real-world problem. Students make water filters to sort materials by size, and then consider how evaporation and condensation could be used to sort out dissolved substances.

Students are challenged to apply this learning to sort out a mixture of stones, sand, salt and staples. And in technology, girls explore how clean water can be found deep underground, and how rocks fulfil a similar function to our water filters. Then, focusing on technology and engineering, students work to build water pumps.

Reception experience Newton's third law of motion

Our youngest students enjoy experimenting with floating and sinking through water play. In STEM lessons students make boats, powered by balloons. Each girl experiences blowing up balloons and letting them go to propel the boats forward. It is great fun, and they discover that 'the bubbles push backwards, and the boat goes forward'. At this moment, students alight on Newton's third law of motion, through practical observation. This very early observation and application of STEM ideas is a vital part of our approach.



Yingting Qian STEM Lab



A space for experimentation, design and innovation

In 2021, we were delighted to open the doors to our new STEM lab. Set in the grounds of our Preschool and Junior School, this new development is central to taking our STEM provision for our younger students to the next level.

Building on our long-established reputation for excellence in STEM, the Yingting Qian STEM Lab provides a dynamic learning space in which girls can experiment, explore, design, test and perfect their STEM innovation ideas, using the very latest resources and equipment.

The STEM lab incorporates clever design elements which integrate scientific principles in its construction. For example, the folding tables rely on the Principle of Moments, as each side of the hinge is carefully weighted, allowing it to move and function around the pivot – demonstrating turning forces in action.



The creation of this new learning space was enabled by a generous personal donation from a former St Mary's girl, Ivy (Yingting) Qian. Ivy attended St Mary's Sixth Form from 2012 to 2014 as an international boarding student. Her donation reflects her gratitude for all that the Headmistress and her teachers and boarding staff did for her as she laid the foundations needed to achieve her academic and career goals.

After St Mary's, Ivy continued her education at the University of Cambridge, where she ranked top five in her second year and was awarded a Knight Third-Year Scholarship and the Anne Jemima Clough Prize at Newnham College. Post-graduation, Ivy completed an investment banking internship at Morgan Stanley in Hong Kong before joining Blackstone in London. Ivy now works in Shanghai for Goldman Sachs.

'We are hugely grateful to Ivy for her very generous donation. The new Yingting Qian STEM Lab will allow us to inspire our very youngest students through our specialist STEM curriculum and lay the groundwork for future careers in this exciting sector.'

Charlotte Avery, Headmistress

Empowering young coders

Achieving national competition success

From: Andrew Severy, Computer Science Coordinator

It has been another busy year for our aspiring computer scientists. Here, Mr Severy reflects on the key successes and new developments from the past 12 months.

The opening of our new Preschool saw us extend our Computer Science curriculum to include pupils aged 3 to 4. The Preschool scheme of work develops basic coding skills in preparation for moving up to Reception class. Preschool girls have had great fun exploring sequences of instructions (especially directional commands) using a variety of devices and equipment. This has included laptops, tablets, a 'BlueBot' (Bluetooth-controlled robot) and their firm favourite a 'Code-A-Pillar' robot caterpillar!



Our new Yingting Qian STEM Lab has provided a dedicated, flexible space for Computer Science lessons, allowing teachers to tackle even more ambitious projects across the Junior School.

Bebras UK Computational Thinking Challenge

In November, all girls in Years 2, 4 and 6 took part in the Bebras Computational Thinking Challenge. This online competition involves solving complex problems against the clock, using computational thinking skills such as algorithm design, pattern recognition, logic and abstraction.

St Mary's students competed against schools across the UK, with over 300,000 students participating. Our girls achieved outstanding results compared to both Cambridgeshire and UK performance levels. In addition to whole school results, students received certificates for individual achievements compared to national data, with Merit and Distinction categories awarded for exceptional performances.

- Over three-quarters of Year 4 and 6 students gained a Merit or Distinction
- Two-thirds of Year 2 students gained a Merit or Distinction
- Four Year 6 students scored in the top 10% nationally, qualifying them for the Oxford University Computing Challenge 2022

Oxford University Computing Challenge (OUCC)

In 2021, four Year 7 students returned to the Junior School to participate in the 2021 OUCC competition, having qualified due to their exceptional results in Year 6. Following studious preparation, they competed in the Junior Challenge against 4,142 students across the UK.

- All four students achieved a Merit placing them in the top 17% of competitors
- Diya S. gained a Distinction for her amazing score of 85% (one of just 101 Awards presented nationally)



'Once again, St Mary's students demonstrated their resilience, perseverance, and enthusiasm by competing under pressure at the highest level. All their hard work really has paid off and they should be extremely proud of what they achieved.'



We love Mathematics at St Mary’s

Exploring the fascinating world of numbers

Quashing stereotypes surrounding Mathematics

In Preschool and Junior School, we introduce fundamental mathematical concepts. Our aim is not just to enable students to get ahead in this vital subject, but to quash any stereotypes surrounding Mathematics and its perceived ‘difficulty’ before they emerge. Students see the creativity in STEM subjects and are encouraged to explore the fascinating world of numbers.

Here are just a few selected highlights from our recent Mathematics lessons:

Getting snappy with symbols

As Year 1 studied reptiles, their Mathematics lessons got snappy – with the help of a friendly crocodile to assist in identifying different mathematical symbols, including more than, less than and equal to. Students had lots of fun pretending to be the crocodile opening its mouth to eat the greatest number!



Combining coding, art and mathematical skills

In this fun challenge, Year 1 students were given a large sheet of paper and worked in pairs to program a BeeBot robot. Each robot held a pen, and students formulated the correct sequence of coding instructions to move the BeeBot around the paper to draw geometric shapes. Students then coloured in segments of the shapes to produce a stained glass window effect. This task emphasised the importance of teamwork, perseverance and accuracy in giving instructions through a creative activity which produced impressive results.

Hands on geometry

In Year 6, students applied their knowledge of geometric shapes to plot coordinates and translate and reflect shapes across four quadrants. Students were challenged to push themselves and to work collaboratively to answer complex questions, developing their High Performance Learning Skills in verbalising ideas and reasoning.



‘Our aim is not just to enable students to get ahead in this vital subject, but to quash any stereotypes surrounding Mathematics and its ‘perceived difficulty’ before they emerge.’



‘The Year 8 enrichment programme empowers girls to find their voice in STEMM, an area traditionally regarded as one that girls may not feel is ‘for them’.



Adventures beyond the classroom

Extra-curricular opportunities in STEM

Year 8 STEMM Awards

We were keen to talk to Holly Bielby, our Biology Technician, to find out more about the extra-curricular adventures of students who have been working towards their Junior Youth STEMM (Science, Technology, Engineering, Mathematics and Medicine) Award.

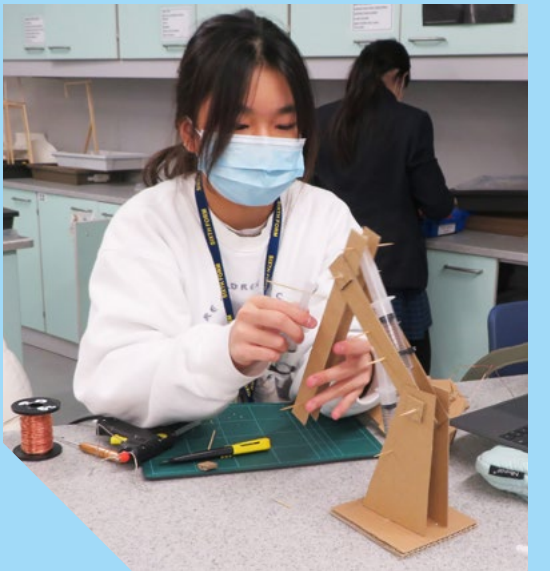
Holly described how this year students have been able to take their first foray into Microbiology, through an investigation into the best material for creating door handles to help prevent the spread of bacterial, fungal and viral infections. Students used non-pathogenic bacteria to practise aseptic techniques whilst creating microbial lawns. New techniques were deployed to test household substances – many of which possess natural antimicrobial properties, such as garlic, ginger and mouthwash.

In a series of enrichment sessions, students explored STEMM concepts, applying knowledge to consider and discuss unexpected results and adapting their approach through experimentation and reflection. Students honed the new skill of operating micropipettes, using research equipment rarely available in school settings. They also enjoyed plenty

of discussion about microbes in Medicine and Food Technology. Mathematics featured throughout the project, for example, in measuring sample sizes or zones of inhibition and in formulating calculations. As well as antimicrobial performance, door handle materials were also tested for durability, heat and electrical conductivity and chemical reactivity. Cost and environmental impact were also considered as part of the overall analysis. Working independently students presented their findings in scientific research posters, building both their research and oracy skills. They explored primary research and scientific journals, including peer-reviewed papers written by St Mary’s science teachers. The final aspect of the project involved using Python to design and code a fun, interactive game.

Young Engineers Club

Our aspiring engineers enjoy Young Engineers, a popular weekly lunchtime club. This club offers a balance of individual and team engineering projects, tailored to suit different ambitions and interests. This year, students in Years 7 and 8 have enjoyed designing and constructing lighthouses, whilst older students have built mechanical arms, powered by hydraulic systems. This extra-curricular club is a great opportunity for students to gain a breadth of skills and to build experience in conducting experiments through engaging, fun challenges. It is also highly-effective in raising the profile of engineering – an area in which women currently make up just 14.5% of the workforce.





STEM star achievers

A year of celebrating success

With a flurry of prestigious science awards and competition wins under their belts, we are confident that our talented STEM stars will go far. This year has been one to celebrate, with achievements in a variety of STEM endeavours.

Youth STEMM Awards

In the highly respected Youth STEMM Awards (YSA) we are extremely proud of Sixth Form students Medeea G. and Amelie A. who achieved Silver and Bronze awards respectively. Former Sixth Form students, who have now moved on to university, also achieved YSA Bronze awards including Emma G., Imogen H., Keeve M., Maria K., Safiya D. and Sophie C.

YSA is a nationwide award scheme which aims to support and inspire the next generation of STEMM enthusiasts. The awards are open to students aged 13 to 19 and each award covers four strands:

- 1. Inspiring the next generation
- 2. Engaging the public
- 3. Developing your skills and knowledge
- 4. Shaping your future

To support our students' YSA work, we provide extra-curricular sessions in school, which offer much-needed time and space for students to identify and plan activities that form the basis of their award application. This supportive approach catalyses student engagement and encourages them to articulate and share their personal journey on a weekly basis.

Biology Olympiad successes

In 2021, our Sixth Form students entered in the national Biology Olympiad. This online competition is open to all Sixth Form biologists in the UK, and the contest extends and applies the A Level curriculum to unfamiliar contexts.

Two former Year 13 students excelled in the 2021 competition, with Emily C. achieving Bronze and Keeva M. being Highly Commended. Congratulations also go to current Year 13 student, Alice G., who was Highly Commended – a significant achievement as she took part whilst in Year 12.

Chemistry challengers

In the competitive Cambridge Chemistry Challenge, Victoria W. achieved a Silver award and Ivy L. achieved a Bronze award. In addition to this, three teams of Year 12 students took part in our internal 2021 School's Analyst competition. Whilst only one team won, certificates were presented to the other two teams for their exemplary teamwork.

CREST Award for Year 7

We have broadened our extra-curricular offering for STEM in Year 7 with a new opportunity to work towards the Bronze CREST Award. This initiative introduces students to STEM project work and empowers them to work like real scientists, technologists, engineers or mathematicians.

Each Friday, CREST students work on a project, completing +10 hours of work, to research, plan and execute their project independently. Students experience collecting data in cycles until they have enough to conclude their investigation and write up their findings. They are supported by teachers who provide guidance, supervision, and safe access to equipment and chemicals.

CREST Award projects

- The bath bomb challenge
- Researching plant growth and nutrients
- Exploring the question 'what is in food?'

Mathematics challengers

Every year, St Mary's students participate in the national Mathematics Challenge competitions, run by the UK Mathematics Trust. This 90-minute, online multiple choice test promotes mathematical reasoning, precision of thought and fluency in applying mathematical techniques to solve problems. This year students achieved a stunning set of results!

Intermediate Mathematical Challenge Stars (Years 9 to 11)

- Year 9: Niamh B. achieved a Silver award, placing her Best in Year and qualifying for the Grey Kangaroo competition
- Year 10: Charlotte B., Chuge J., Hannah P., Isla T., Zoe W., and Yao X. achieved Silver awards
- Year 11: Bianca L., Jasmine H., Sophie G., and Sonia W. achieved Gold awards, qualifying for the Pink Kangaroo competition
- Jacy T. (Year 10) was placed Best in Year with her Gold award
- Bella C. (Year 11) placed Best in Year
- Elizabeth G. (Year 11) topped our school's results with an amazing 122 points, achieving a Gold award and qualifying for the Maclaurin Mathematical Olympiad

Senior Mathematical Challenge Stars (Years 11 to 13)

- Year 11: Tabitha B., Natasha L., Anna L., Sally M., Hattie R., Rennie Y. and Amy Y. achieved a Bronze award
- Year 11: Abby C. achieved a Silver award
- Year 11: Elizabeth G. achieved a Gold award and the Best in School award, qualifying for the Senior Kangaroo competition
- Year 12: Bernice C., Medeea G., Sophia L., Obelia L., Peony L., Nicole T., Elena W., Katherine W. and Ivy W. achieved a Bronze award
- Year 12: Maryam G., Susan S., Cecilia Y. and Lisa Z. achieved a Silver award, with Lisa placed Best in Year
- Year 13: Sophia Z. and Xinyi Z. achieved a Silver award, with Sophia placed Best in Year



'I would like to congratulate all students who have worked exceptionally hard and gone the extra mile to take part in these prestigious STEM awards and competitions. It's a true reflection of the commitment, enthusiasm and self-motivation of our students and their genuine love of these subjects.'

'At St Mary's we are 100% behind the drive to promote women in STEM and entering these kinds of programmes really helps our pupils stand out from the crowd. We can't wait to see what the future holds for these STEM stars.'

Charlotte Avery, Headmistress



Engaging scientific minds

EPQs with a STEM twist

At St Mary’s, we aim to give girls the confidence and skills to find their own path in life. As a High Performance Learning (HPL) school, we help students to develop skills and personal qualities that are vital for their future success, such as problem-solving, planning, resilience and intellectual independence. The Extended Project Qualification (EPQ) nurtures all these qualities.

In Sixth Form, EPQ students conduct deep research into their interest area to produce an outcome of their choice, either a written report, event, artefact or design. Gaining an EPQ helps university applications stand out and equates to half an A Level (24-28 UCAS points).

Recently, some of our most successful EPQ projects have explored STEM-related themes. Despite the challenges of Covid-19, the pandemic sparked new conversations and lines of scientific enquiry, as our EPQ students worked to better understand our times, our relationship to history and the consequences of the pandemic.

Impact of Covid-19 on Low-Income Developing Countries (LIDCs)

Ohona K.

Ohona’s EPQ focused on the devastating impact of Covid-19 in low-income developing countries (LIDCs), where hospital beds and medical equipment are often in low supply.

Bangladesh formed Ohona’s central case study, informed by the testimony of family members living there. Her study highlighted the lack of support offered to these countries from abroad and her findings were presented on an interactive website, which featured links to donate to crisis relief.

Ebola in West Africa in 2014

Victoria W.

Victoria opted to study past health crises, exploring the 2014 West Africa Ebola outbreak. Her EPQ investigated factors that contributed to making this outbreak particularly catastrophic, from politics to the environment and the effectiveness of first responses, with implications for today.

Weighing up all factors, Victoria concluded that the novelty of the outbreak heightened a lack of understanding on which measures would be effective. The resulting confusion was particularly deadly, especially when combined with high transmission rates.

Her research helped her to draw comparisons with Covid-19 in relation to the impact of misinformation and individual choice on recent events. This EPQ bridged Victoria’s transition to university by building referencing and long-term planning skills, and allowing her to explore her interest in virology.

A Complete Guide to Face Masks

Alice G.

Alice combined an interest in the science of pandemics with her love of sewing to produce a complete guide to face masks. Her EPQ covered all

aspects of masks, from their history during plagues and in other cultures, to the science behind their effectiveness, correct use, and construction.

Alice produced a series of handmade masks, experimenting with fabrics and design to create a ‘perfect’ mask, with ideal fit and breathable fabric. This project allowed Alice to build new textiles skills, whilst working towards a subject with direct relevance to her ambition to study Bioscience at university.

The Psychological Impact of the Pandemic on People with Autism

Niamh B.

Niamh was inspired to learn more about autism and to follow her interest in Psychology. Interesting dilemmas arose from studying the present, as Niamh found herself facing a wealth of conflicting sources. She decided to use official government documents to review the impact of Covid-19, and to supplement this research with interviews.

For her central case study, Niamh interviewed the mother of an autistic child. In her measured report, she noted that while isolation and stress had caused new difficulties, some children had experienced certain benefits. Online school lessons, for example, allowed some children to learn in a familiar, less stressful environment, improving their experience.

The Effects of Social Media

Kirsty C.

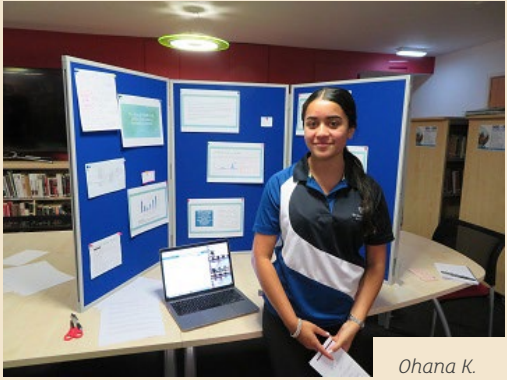
Kirsty’s EPQ explored the effects of social media – a topic given greater relevance by the centrality of social media to staying connected during the pandemic. Having originally set out to study the effects of social media on teenagers, Kirsty’s project developed with further research, as she learned that 18 to 24 year olds were the most impacted demographic.

In her research essay, Kirsty drew on academic articles and online sources, assessing the role of social media on deepening depression and anxiety, and in allowing us to build friendships and stay connected. She explored these phenomena on a personal, local and international scale, comparing social media use and its impact across countries.

Completing this EPQ enabled Kirsty to explore her interest in psychology. Reflecting on the impact of the pandemic on this subject, Kirsty identified new uses of social media, as more people relied on online life to stay connected and informed. Recognising the power of social media for harm as well as good, Kirsty recommended filter settings to help limit contact with harmful information and reduce potentially negative impact.



Alice G.



Ohona K.



Victoria W.

‘These EPQ projects form a time capsule of this unprecedented period, and demonstrate the resilience, curiosity and creativity of our Sixth Formers, who used the time and experiences of the pandemic to undertake inventive research.’



Thriving and inspiring

STEM in Sixth Form

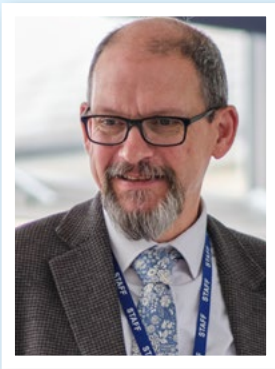
Profile: Robin Griffiths, Head of Sixth Form

Our Head of Sixth Form, Mr Griffiths dedicates time to advising students on STEM career pathways and placements. We caught up with Robin to discuss his love of Physics, his experience as a teacher and how St Mary’s helps students to make the most of STEM subjects.

As a graduate of Imperial College, and a Fellow of the Institute of Physics, Mr Griffiths was first attracted to Physics at an early age. Indeed, he attributes his decision to teach to his desire to communicate and share this fascination with others.

‘I always loved Physics, not just because it grappled with the big questions, like where the universe comes from, but because it covers the small questions that bamboozle you, like why some of the light hitting a window reflects off it, while some of it passes through. It helps you to think about and question experiences of the world that you may have taken for granted previously.’

Mr Griffiths taught at Saffron Walden County High School from 2007, where he progressed to Head of Physics, remaining there until 2017. This gave him first-hand experience of some of the difficulties of teaching Physics, including the shortage of teachers in the UK and its impact. The shortage of Physics specialists, especially in state schools, motivated Mr Griffiths to address this gap as Head of the Teacher Support Programme at the Institute of Physics. There,



he worked on a series of government projects before returning to the classroom at St Mary’s in 2019.

At St Mary’s, he has observed a great enthusiasm for STEM subjects: ‘The girls are fantastic. They’re always keen to learn and enthusiastic. It’s wonderful because every lesson is focused and they love to hear new ideas, build up their understanding, and achieve fantastic results.’

As Head of Sixth Form, Mr Griffiths is keen to maintain our thriving A Level STEM provision. He describes what sets our approach to STEM apart: ‘We have a thriving A Level science programme, and the sciences prove popular choices here. Every year lots of students apply to study STEM at university, including at Oxbridge colleges, and this year, we are proud to have a student accepting an unconditional offer to study Chemistry at Oxford.

‘Our success is built on our superb facilities and opportunities. For example, the Youth STEM Award, an enrichment opportunity, gives students a chance to keep up with the world of science. And I’m especially proud to see our older students getting involved with younger girls, to help bring on their science education.

‘This would not be possible without our fantastic labs and facilities. We have two bright, modern, and airy labs for each science. And, because we have small class sizes, students don’t have to share equipment,

so their experience is very practical-focused. We’re very fortunate that students can fully experience these subjects, and what’s more, we have specialised technicians, one per science, to help prepare facilities and run experiments.’

Mr Griffiths clearly enjoys teaching, but he also finds great reward in supporting students in achieving their STEM career ambitions:

*‘Last year, it was lovely to work with a student who went on to study Architecture at university. Her A Level subjects included Physics and Art, and she was brilliant, getting A*s in both. Seeing a student achieve so highly in science and arts subjects in order to achieve her career ambitions was very rewarding.’*

He also notes that at St Mary’s, many students study a science A Level, even when planning different university or career paths. This, he suggests, is testament to the quality of teaching, which makes science fun and engaging. Indeed, Mr Griffiths is always questioning how best to teach his subject, and combined with the issues raised during his time at the Institute of Physics, this has inspired him to launch his Physics teaching podcast:

‘One challenge is to encourage more Physics graduates into teaching, and to support those who didn’t specialise in Physics. In state schools, most of those who teach Physics aren’t specialists, and with the best will in the world, they can find themselves at a bit of a loss as to how to teach this subject. After many conversations about it with a teaching colleague, we decided to set up a podcast to celebrate and support Physics teachers.’

Whilst they originally tailored the podcast to a UK audience, listeners now tune in from across the globe. The content has grown to reflect this, and

they have met and talked to teachers and education experts from all over the world, from Peru to America.

Now in its fourth season, Mr Griffiths continues to shape the podcast around current issues in the field. A recent episode, focused on ‘Girls in Physics’. This episode highlighted that although girls outnumber and outperform boys in most sciences at A Level, Physics still has a comparatively low take-up for girls, with girls making up roughly 20% of the field. Mr Griffiths reflects on this issue and the impact a single-sex education can have:

‘There’s a great need to address gender bias in Physics. I do see a difference in teaching at a single-sex school. As we found at the Institute of Physics, uptake for Physics A Level is higher at girls’ schools than in co-ed ones, which makes a great case for single-sex education. Until we crack society-wide stereotypes, anything that eradicates this gap is worthwhile. And, those girls who do Physics at A Level outperform boys, which shows what nonsense the stereotypes are.’

‘To any students considering A Level Physics, Mr Griffiths says: ‘go for it! There are a lot of myths around the subject (too hard, too much Maths) but this is not true. Yes, there are some mathematical techniques needed but once you have mastered them there are no big surprises, and as for it being hard, Physics awards as many A grades as any other subject, so it is no more difficult. What it will do is challenge you to think differently about the world, which can be unsettling at times, but even this is an excellent skill to pick up in a changing world.’*





'Nature improves learning outcomes, such as retention of knowledge and improved grades, and develops better leadership, communication and problem-solving skills.'

A breath of fresh air

The powerful impact of nature on learning

Seeing good in all creation is one of our 12 characteristics as a Mary Ward School. During the past year, staff and students have worked together to bring outdoor learning into both academic and pastoral activities. Our aim is to support the development of student self-esteem, resilience, health, and understanding of and care for the environment.

The Covid-19 lockdowns in 2020 and 2021 created time for people to reconnect with the outdoors. The benefits of spending time outdoors for mental health and well-being are well documented and at St Mary's we are exploring how to incorporate more opportunities for outdoor learning in Senior School and Sixth Form.

Additional research shows that exposure to nature also has tangible benefits for learning. It has been shown to improve concentration, engagement and self-discipline. Nature also improves learning outcomes, such as retention of knowledge and improved grades, and develops better leadership, communication and problem-solving skills.

Rainforest retreat

Thanks to the support of the Circle of Friends, a Tropical Rainforest space has been installed in one of our Sixth Form teaching rooms, to create a biophilic classroom.

As students spend the majority of their time indoors, this pilot aims to connect students with nature from inside a built environment. Large plants have been arranged at varying levels to replicate a rainforest environment. In addition, plants have been selected to represent the main layers of the rainforest, with the tallest plant reaching 7ft, and different species reflect the diversity, colour and beauty of the rainforest environment.

Embracing the outdoors

Work has also begun on a new outdoor classroom, due to open later this year. Crafted from sustainably-sourced, natural redwood timber, this space will

remove the constraints of an indoor classroom and create a thriving outdoor working environment, come rain or shine. New outdoor learning pods in Chapel Garden, used for academic and pastoral activities, will supplement this new learning environment.



All departmental teaching curricula are being adapted to include opportunities for lessons and home-learning tasks that incorporate access to the outdoors. We are committed to providing students with environments and experiences that continue to inspire them, and we can't wait to see how this programme continues to develop.

Growing for well-being

Cultivating Change is a seed donation initiative run by former St Mary's students. We are collaborating with them to promote the value of gardening in promoting mental and physical well-being. Our Gardening Club is supporting a new Grow, Cook and Eat initiative, which involves students learning to grow vegetables (donated by Cultivating Change) before cooking them during Food Technology lessons.



STEM solutions for real-world challenges

Our Eco Committee in action

St Mary's is fortunate to have a dedicated Eco Committee led by a group of committed students. They aim to deliver initiatives that ensure our school tackles challenges facing our environment at a local, national and international level.

From ecology and conservation to broader skills such as problem-solving and tech innovation, STEM subjects have plenty to offer in terms of how we tackle the big challenges facing us on biodiversity, sustainability and climate change. Our proactive Eco Committee is taking action in key areas including:

- **Protecting marine environments:** Raising awareness of ocean pollution and charities taking action on this problem
- **Reducing waste:** Changing how the school manages waste and implementing ways for students and staff to refuse, reduce, reuse, repair and recycle
- **School environment:** Improving outside areas and student interaction with nature whilst in school

To achieve their aims, the Committee has already delivered several projects, such as 'Eco Wednesdays' which have been a huge hit, offering green activities for all, such as upcycled crafts, broadcasting environmental documentaries and making reusable face masks. The Committee has also partnered with the ReWorked scheme to divert plastic waste from landfill. ReWorked transforms waste into products such as chairs and plant pots. The entire school has



contributed to this initiative – a great achievement! And, for World Wildlife Day, students were invited to bring in plastics to create an artwork of a whale's tail. The finished piece highlights ocean pollution and is part of an art display incorporating learning resources on ocean pollution.

Eco School Green Flag

With Eco Committee progress gathering pace, we are now striving to gain the international Eco School Green Flag Award. This endorsement recognises environmental action in schools and is a great way to celebrate ecological achievements. Watch this space for news on progress!

'Keep up the great work girls and a big thank you to everyone for their support of our commitment to becoming a more sustainable and environmentally friendly school.'

Charlotte Avery, Headmistress

Chemistree Challenge

GCSE chemists took part in the fun Royal Society of Chemistry's Chemistree Challenge to design and create their own festive chemistree design, incorporating 20 elements from the periodic table.

This year's Challenge was themed around 'Energy and Sustainability' in connection with the UN Climate Change COP26 Conference. Students responded with a brilliantly creative design, decorated with bioplastic decorations (made from milk) and topped with a lemon-powered LED light.



Opening up STEM careers

Unparalleled opportunities on our doorstep

Cambridge’s thriving tech scene and world-class educational institutes provide unparalleled STEM opportunities for all our students, and older girls can access work placements with global science, technology, biomedical and pharmaceutical companies located in and around the city.

In 2021, the pandemic paused our usual in-person work placement scheme; however, a myriad of flexible virtual career activities ensured there was no shortage of experiences on offer – as this snapshot of our Autumn Term activities highlights.

Year 11 Employability Day

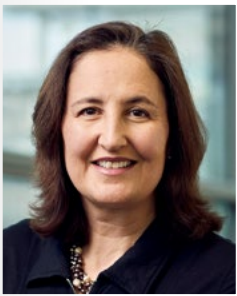
Senior School students benefited from Cambridge employers who kindly visited us to share their professional insights and expertise. This event helps students consider future career options and to prepare for their next stage in education and beyond.

InvestIN Education

InvestIN offers unique, immersive career experiences for young people aged 12-18. In 2022, individual St Mary’s students will embark on The Young Vet Summer Experience and the Young Management Consultant Experience.

Volunteering in STEM

Students have enjoyed rewarding volunteering opportunities at the Whipple History of Science Museum, Cambridge and through the Young Person’s Volunteering Programme with Cambridge University Hospitals.



St Mary’s Alumna Diane Chadwick-Jones provided a fascinating insight into her 30-year career at BP, advising students on how to speak up about issues, build alliances and leverage mentors.

Diane joined the BP from Imperial College, London, and held leadership roles in several sectors including refining, exploration and chemicals, working in Belgium, Brazil and Egypt. She is also an advocate and mentor, focusing on increasing the representation of ethnic minority STEM talent in industry, and was recognised for her contribution by being included in the 2019 EMpower UK Top 15 Ethnic Minority Advocate list.

Virtual STEM careers inspiration (Autumn 2021)

September 2021

- PwC Females of the Future virtual careers event
- Studying Medicine - webinar series from Leeds University
- Introduction to Veterinary Medicine from University of Nottingham

October 2021

- UK Government Communications Headquarters (GCHQ) virtual work experience
- ARM Cambridge virtual work experience
- Facebook virtual work experience
- Thinking Ahead engineering taster programme from TEDI London
- Lunchtime Medical Lecture Series (Oct-Dec) from University College London
- Brighton and Sussex Medical School virtual work experience (Oct-Dec)

November 2021

- Tales from the Boardroom with St Mary’s Alumna Diane Chadwick-Jones
- Empowering Women in Banking and Finance from The London Institute of Banking & Finance
- Pharmacy, Dentistry and Radiotherapy Taster Sessions from Cardiff University
- Careers in Aerospace, Technology, eCommerce, Finance and Entertainment - STEM Virtual Summit
- Online Masterclasses in Engineering and Economics from the University of Cambridge
- Where Can a Biochemistry Degree Take You? from Swansea University
- Getting into Medicine webinars (Nov-Dec) from The Medic Portal

Students also accessed STEM lectures and events from The Royal Institution, the University of Cambridge and Cambridge University Hospitals.

December 2021

- ARM Cambridge virtual work experience
- Sixth Form lectures (Dec-Mar) from University of Cambridge, Department of Physics

Where are they now?

STEM successes beyond St Mary’s

We love hearing from our alumnae about their exciting next steps after St Mary’s. This year, we have been delighted to catch up on plenty of inspiring STEM career news, from excellence in further education to consulting on Sky News’ Climate Show.

Sisi (Hu) Xi: Harvard Research Fellow and Consultant on Sky News’ Climate Show

Recently we had an update from Sisi (Hu) Xi. It was amazing to learn about her experiences as a Harvard Research Fellow and that she appears regularly as a Consultant on Sky News’ Climate Show. Sisi was one of the students in our first cohort of international students.

Ludo Caldera (2011-2016): Masters at Edinburgh University in Environmental Sustainability

Ludo graduated from Newcastle University in 2021 and is now studying for a Masters at Edinburgh University in Environmental Sustainability. She is enjoying the course and Edinburgh!

‘In recent years, over a third of leavers have secured STEM-related university courses.’

Wenwen Li: Associate Director in Business Planning & Operations, Chief Operating Office, BioPharma R&D at AstraZeneca

Wenwen, who is Sisi’s cousin and was in the same year group, is now Associate Director in Business Planning & Operations, Chief Operating Office, BioPharma R&D at AstraZeneca in Cambridge.

Karla Mohoric (2012-2017): Masters in Neuroscience at King’s College London


Karla graduated this year from Oxford Brookes University with a First in BSc Psychology, achieving the highest GPA (Grade Point Average) in her year.

Her next step will be to study for a Masters in Neuroscience at King’s College London starting in September. We received a lovely letter from her saying how grateful she was for Mr Quirk’s superb teaching, which inspired her to study psychology.

Bonnie Au (2009-2014): Freelance journalist based in Hong Kong

As well as working as a freelance associate video producer at the South China Morning Post, the largest English-language newspaper in Hong Kong, Bonnie has launched an environmental news podcast, GreenBites, via the NGO Sustainable Asia.

GreenBites provides a weekly news round up on the latest environmental news in Asia. With Sustainable Asia, Bonnie also produces podcast documentaries on environmental topics, including plastic waste pollution, marine protected areas in Antarctica and illegal pangolin trafficking in Asia.



www.sustainableasia.co



Leaver destinations

In recent years, over a third of leavers have secured STEM-related university courses. Their destinations span everything from Architecture at the University of Nottingham, Biochemistry at UCL, Medicine at Cardiff University and Physics at the University of Edinburgh, to Computer Science at King’s College, Engineering at Imperial College and Veterinary Science at the Royal Veterinary College.

For us, there really is no better proof that all STEM subjects are very definitely ‘for girls’. These leaver destinations are the best measure of our success in STEM education, and we can’t wait see what these amazing young women achieve.

Recent leaver destinations		
STEM sector	University course	
Finance	<ul style="list-style-type: none">Accounting, Business Finance & ManagementActuarial ScienceAccounting and Finance	<ul style="list-style-type: none">Investment and Financial Risk ManagementMathematicsMathematics and Statistics
Architecture and design	<ul style="list-style-type: none">Architecture and Environmental DesignArchitecture	<ul style="list-style-type: none">Built EnvironmentDesign for Branded Spaces
Science	<ul style="list-style-type: none">Biological SciencesPhysics	<ul style="list-style-type: none">GeologyChemistry
Conservation and environment	<ul style="list-style-type: none">Conservation Biology and Ecology	<ul style="list-style-type: none">Environmental Sciences (Ecosystem Management)
Medicine and health	<ul style="list-style-type: none">Biomedical ScienceDentistryMedicineNeuroscience	<ul style="list-style-type: none">Nutrition and Medical SciencesPharmacyPhysiotherapyVeterinary Science
Technology	<ul style="list-style-type: none">Computer Science	
Engineering	<ul style="list-style-type: none">Chemical EngineeringCivil EngineeringElectronic Engineering	<ul style="list-style-type: none">EngineeringMechanical Engineering

STEM subjects at A Level – St Mary’s Sixth Form versus the national average (2021)		
Subject	St Mary’s Sixth Form	% Students nationally
Biology	34%	8%
Chemistry	34%	7%
Physics	10%	5%
Mathematics	40%	12%
Further Mathematics	10%	2%
Computing	6%	2%

National figures source: <https://www.gov.uk>

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