

CREATIVE

JUST ADD

IMAGINATION

Creative science and maths activities  
to inspire imaginative futures

IDEA

DESIGN

# JUST ADD IMAGINATION



Science and maths are the springboard to a vast range of rewarding careers – not just in research, but in business, charities, teaching, engineering, medicine, computing, design, and many other areas.

The only limit is your imagination

Research shows that **support and encouragement from family and friends** can give children the confidence to access these exciting opportunities.

This pack is full of ideas to help you **explore science and maths careers** at home.

Eight people **demolish myths** about who belongs in science, technology, engineering and mathematics (STEM), and share their own pathways into exciting roles.

Doing the activities with your child will help show them **what science and maths are really like** – not lists of facts to be learned, but ways of thinking, creating, and exploring the world.

Don't worry if you're not familiar with STEM subjects and careers – **the Talking Points will help you get talking about science and maths in everyday life.**



It's a **myth** that girls are not keen on science, technology, engineering and maths – in fact girls outperform boys in STEM qualifications at all levels<sup>1</sup>.

SCIENCE AND ENGINEERING  
ARE PLAYING WITH PURPOSE

Where will your imagination take you?

<sup>1</sup> [https://www.wisecampaign.org.uk/uploads/wise/files/not\\_for\\_people\\_like\\_me.pdf](https://www.wisecampaign.org.uk/uploads/wise/files/not_for_people_like_me.pdf)

# SCIENCE AND MATHS ARE FOR EVERYONE!

Studying science and maths is a great way for your child to keep their options open. There are exciting science, technology, engineering, and maths roles to suit EVERY curious mind.

**INVESTIGATOR**

I like solving problems

**BUSINESS**

I like persuading others

**EXPLORER**

I like finding out new things



Help your child match their characteristics and aspirations to the Science Council's 10 types of scientist working today. Find out more at [www.sciencecouncil.org/10-types-scientist](http://www.sciencecouncil.org/10-types-scientist)

**ENTREPRENEUR**

I like turning ideas into opportunities

**REGULATOR**

I like making sure things are done properly

**DEVELOPER**

I like turning knowledge into action

**TEACHER**

I like helping others to understand science

**COMMUNICATOR**

I like getting people excited about science

**POLICY MAKER**

I like to shape laws and policy

**TECHNICIAN**

I like helping people



# JUMANA HAQUE

## FOUNDATION YEAR PHYSICS STUDENT

Jumana is taking part in the new Foundation Year program at Lady Margaret Hall, Oxford. The course aims to attract bright students from areas where higher education isn't the typical or easiest path to take.

**I used to think studying physics would be near to impossible for someone like me.** No one in my family had been to university before or worked in science, technology or engineering. But my parents have always supported me and have never limited my aspirations.

**My greatest inspirations are my mum and her parents.** They had the ability and potential to do something great but due to their circumstances could never move on to higher education. They never would have expected me to be where I am now, but it is due to their support that I'm here.

**At school I always asked a lot of questions – and often baffled my teachers!** This quest for finding answers and having my mind blown is what really drew me to physics.

**Being a girl from a South Asian family made the decision to study physics difficult.** My family wasn't sure if the course would lead to a specific job, like medicine or law. I decided to do an internship at Citi Banking Group, where the people in my department were physicists and mathematicians. This showed my family that I could go on to do a whole host of jobs.

**Physics is about answering questions. It's the foundation of all the other sciences.** It broadens your mind and teaches you many transferable skills along the way. It's a rewarding and exciting journey.

Foundation Year Programme at the University of Oxford

Internship at Citi Banking Group

A Level Maths, Chemistry and Physics, AS English Literature

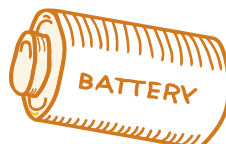
Maths and Triple Science GCSEs

### BEST ADVICE?

If you're good at what you do and you enjoy it, don't step away from the challenge. Regardless of your background, if you're determined and have the opportunity, take it.

### HOW DO YOU RELAX?

Reading is my favourite hobby. It teaches you how to think critically. Reading fiction is important for a scientist, as it feeds your imagination.





# BUILD A SCRIBBLEBOT

**Time:** 30 minutes

**You need:** Empty plastic pot, elastic band, sticky tape, three felt tip pens, small battery-powered motor (these can be purchased at minimal cost online – search for a 1.5V small DC motor), 1.5V AA battery holder, 1.5V AA battery, large piece of paper

## Activity 1. Build your robot

- ✦ Slip the battery into the battery holder, and connect it to the motor. Turn the pot upside down and stick the motor and battery firmly on top. It should be off centre.
- ✦ Use the rubber band to attach three felt tips to the pot, as 'legs'.
- ✦ Take the lids off and place the scribblebot on a flat piece of paper. Turn the motor on.

## Activity 2. Experiment to see what you can create

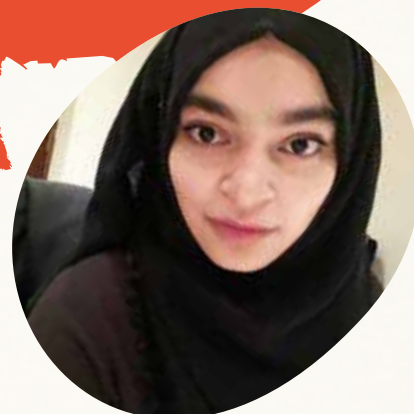
- ✦ Try pushing a lump of squishy material such as cork or plasticine onto the motor shaft (make sure it can turn freely). How does this affect the scribbles?
- ✦ Try changing the shape of the container, or number or type of legs.
- ✦ Can you make the robot draw different shapes and patterns?



Get more tips on building Scribblebots at [bit.do/scribbling](http://bit.do/scribbling) or watch a demonstration at [bit.do/scribblebot](http://bit.do/scribblebot)

Share your creations with Jumana at [oxfordsparks.ox.ac.uk/justaddimagination](http://oxfordsparks.ox.ac.uk/justaddimagination)

I'm a bit of an explorer and investigator; I enjoy probing ideas and seeing how far I can stretch them. As a student it's an important skill to have because it gives you an idea of how science works.



## TALKING POINTS

### #1 Innovate

There are many ways to build a Scribblebot. Encourage children to test and amend their ideas to build something unique.

### #2 Celebrate

Celebrate their science, technology and engineering creations by helping them to display the artworks they create.

## ENJOYED THIS? WHAT NEXT?

- Find out more about the Oxford Foundation Year, which provides teaching and support: [lmhfoundationyear.com](http://lmhfoundationyear.com)
- Visit [www.physics.org](http://www.physics.org) for advice and information about studying physics.
- Find more fun and simple science activities to do as a family at: [bit.do/scienceweek](http://bit.do/scienceweek)



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# ANN-MARIE JAY

## FINAL YEAR EARTH SCIENCES STUDENT

**Ann-Marie was in foster care when she applied to study at the University of Oxford. She's keen to encourage other children and care leavers to follow in her footsteps.**

**I've always been curious.** My parents were very encouraging when I asked how things worked and why things happened. If they didn't know the answer themselves, they helped me look it up elsewhere.

earthquakes and volcanoes, to oceans and the Earth's core. It's pretty awesome being able to say that I'm trying to find answers that other scientists haven't figured out yet!

**Science and maths sparked my interest because they helped to answer my questions.** Now I know that scientists are still trying to answer as many questions as I asked when I was younger!

**My degree is challenging, but I am determined to succeed.** I have completed some fantastic projects, including making my own geological map of an area. Right now, I am working in a laboratory where I get to melt rock chips with a very powerful laser – pretty cool! It's one of the ways geologists find out what different rocks are made of.

**While I was applying to university, I moved in with a foster carer.** She had not been to university but she was extremely supportive. Although she didn't understand much science, she was prepared to hold conversations with me to maintain my enthusiasm.

**I have been involved in a lot of outreach events** through the university and various charities. My original plan was to work for a mining company as an exploration geologist, but that has changed. Now I hope to help support looked after children and care leavers like myself, and encourage them to choose university as an option.

**There is a lot that geologists don't yet understand about our planet.** My course covers everything from

Integrated Masters degree in Earth Sciences at the University of Oxford

Maths, Chemistry and Physics A-levels, Geology AS level

Maths, Biology, Physics and Chemistry GCSEs

### BEST ADVICE?

Don't just go by what your teacher says. Ask how things work and why things happen. Be inquisitive and try to find answers online if you can – the internet is a great resource.



### HOW DO YOU RELAX?

I enjoy being part of an orchestra. At one point I was considering studying music but I decided that my true talents lay in science.





# CREATE YOUR OWN ROCKS

**Time:** 30 minutes

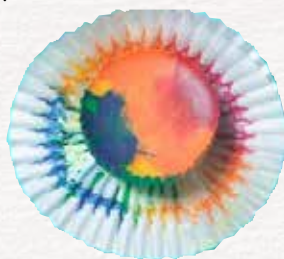
**You need:** Wax crayons (old stubs are perfect), butter knife, cheese grater, muffin cases, hair dryer (or hot water in a mug), rolling pin

## Activity 1. Make sedimentary rocks

- \* Imagine that your crayons are rocks. Use the cheese grater to grind them down into small pieces. These are like the sediments, sand and silt, created when rocks are worn down by erosion.
- \* Sprinkle the sediments into a muffin case, in different coloured layers.
- \* Pop another muffin case on top. Apply pressure by pushing down on the sediments with the end of a rolling pin.
- \* Remove the top cupcake case to reveal your sedimentary 'rock'.

## Activity 2. Make metamorphic and igneous rocks

- \* Heat and pressure can turn one type of rock into another, creating metamorphic or igneous rocks.
- \* Warm your sedimentary 'rock' gently with a hairdryer, or by asking an adult to float it on a mug of hot water. When the wax starts to soften, carefully remove the heat source. Pop the other muffin case on top. Press down with the rolling pin to apply pressure. Remove the top muffin case to reveal your metamorphic 'rock'.
- \* To make igneous rock, repeat the steps above but let the wax 'rock' melt completely before you remove the heat source. Igneous rock forms when molten rock cools and sets.



Visit the British Geological Survey's Make-a-map website to find out where each type of rock is found in the UK.  
[bit.do/makeamap](http://bit.do/makeamap)



Share your creations with Ann-Marie at [oxfordsparks.ox.ac.uk/justaddimagination](http://oxfordsparks.ox.ac.uk/justaddimagination)

I use powerful lasers to melt rock samples and learn about them. At home, you can use old crayons and a hair dryer to learn about the three main types of rocks – and create some unique artwork.



## TALKING POINTS

### #1 Question

Encourage your child to ask questions. There is no shame in not knowing the answer. You can always search for answers online or at the library together!

### #2 Explore

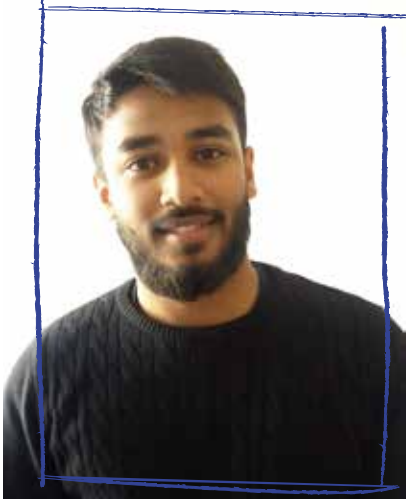
The best questions come from observations. If something captures your child's interest – from rocks in the garden to fossils at the beach – explore it together.

## ENJOYED THIS? WHAT NEXT?

- Rockwatch is the UK's nationwide geology club for children. Visit [www.rockwatch.org.uk](http://www.rockwatch.org.uk) to find out more.
- Find out more about earth sciences at the Oxford University Museum of Natural History. Visit their minerals learning zone online at [bit.do/thezone](http://bit.do/thezone)
- The Geological Society has lots of information about education and careers in earth sciences: [www.geolsoc.org.uk/education](http://www.geolsoc.org.uk/education)
- Visit [bit.do/oxfordsupport](http://bit.do/oxfordsupport) to find out more about support for Care Leavers and UK undergraduate students from a low-income background.



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# MUHAMMAD ALI

## SECOND YEAR ENGINEERING SCIENCE STUDENT

**Muhammad was one of the first in his family to go to university. He explains why studying engineering science makes him happy.**

**Maths and physics have always been my strongest subjects**, but I didn't get interested in engineering until sixth form. My physics teacher ran an aeronautical society, and took us on field trips. If I had 15 spare minutes, I'd read an aviation magazine for fun.

**Don't limit yourself to the subjects you study at school.**

Read about different careers. Ask for advice from people who've done what you want to do. If something interests you, just go for it. If you enjoy your subject, you'll excel.

**Engineering is really interesting.**

You see how the maths you studied at school is used to solve real world problems. I started off wanting to specialize in aeronautical engineering (designing and building aircraft), but I'm keeping my options open. At the

moment I'm interested in biomedical engineering, which mixes biology, medicine and engineering to find new ways to keep people healthy.

**Being Muslim and coming from Tower Hamlets in London, I thought it would be difficult to start at the University of Oxford.**

My mum and dad didn't go to university, but they taught my siblings and me to work hard. When I got here, I got involved with the Islamic Society and found many people from the same background. It's much easier when you find a community.

**I've done a lot of volunteering.**

My dad works with vulnerable adults and during the holidays I volunteer to help run activities. Engineering will also give me that opportunity to help people and give back.

Engineering Science undergraduate at Magdalen College, Oxford

Work experience at a Civil Engineering firm

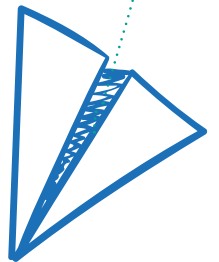
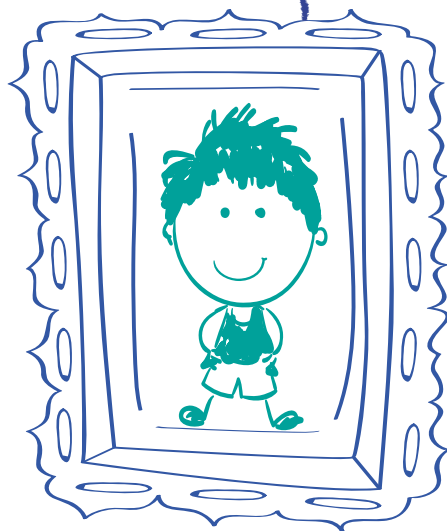
A Levels in Maths, Further Maths and Triple Science

### BEST ADVICE?

Don't just focus on schoolwork – do everything you can to broaden your horizons. I did things to push me out of my comfort zone, like debating and music, even though I wasn't that good at it.

### HOW DO YOU RELAX?

At school I did any sport going – gymnastics, football, hockey. I've always been part of my local football club.





# PAPER ENGINEERING

**Time:** 10 minutes

**You need:** A4 paper, scissors, drinking straws, paper clips, sticky tape, internet access, and safe, open space

## Activity 1. Design the ultimate paper aeroplane

- \* Challenge each person to fold a paper aeroplane from one sheet of A4 paper. Race the aeroplanes to see how far they go.
- \* Visit this website with an adult helper for instructions on folding a record-breaking paper aeroplane. [bit.do/paperplane](http://bit.do/paperplane)
- \* Can you use the ideas in this film to improve your own designs?

## Activity 2. Keep a straw off the ground

- \* Each person needs two strips of paper (10x1cm and 20x1cm), and a drinking straw.
- \* Your challenge is to join the paper to the straw in a way that will keep the straw in the air for as long as possible after dropping or throwing it.
- \* Test your designs by dropping or throwing them from standing height. How can you improve them?

Engineering is a process. If you train to be an engineer you'll learn how to identify problems, brainstorm solutions, build working models and improve your designs. Have a go right now with these aeronautical engineering challenges!



## TALKING POINTS

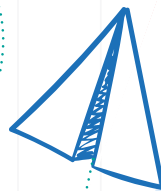
### #1 Keep dreaming

Encourage your child to dream up completely different solutions. Not all paper planes need to look like paper planes!

### #2 Refine

Using an inexpensive resource like paper means you can build and test new models as often as you like. What other materials can you use around your house?

The world record for a paper aeroplane flight is 69.14 metres. Can you design an aeroplane to beat this?



Share your creations with Muhammad at [oxfordsparks.ox.ac.uk/justaddimagination](http://oxfordsparks.ox.ac.uk/justaddimagination)

## ENJOYED THIS? WHAT NEXT?

- Visit [www.tomorrowsengineers.org.uk](http://www.tomorrowsengineers.org.uk) to find out about careers in engineering.
- Young Engineers provide support and guidance to parents of children aged 7 to 19 – check out [bit.do/youngengineers](http://bit.do/youngengineers)
- Find out more about aeronautical engineering at [bit.do/aerosociety](http://bit.do/aerosociety)



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# SOPHIE JAMIESON

## APPRENTICE LAB TECHNICIAN

Sophie talks about her apprenticeship route into a science career, and suggests simple kitchen chemistry projects to fire up your imagination.

**At school, I was excited** when it was time for science lessons. Maths was a different story – I worried I wasn't good enough. I decided to study really hard and came out with a good Maths GCSE. It was a big confidence boost. Enjoying the mathematics used in science helped me grasp the rest.

**I am charting my own path** into the science career I want to be in. When I was 17 years old, I decided to start a laboratory technician apprenticeship instead of taking A-levels. I wasn't the best at exams and learn better by doing hands-on things. The apprenticeship gave me three years of experience, learning practical skills and finding out what it's like to work in a research laboratory.

**Science is exciting because it's all about discovery.** My parents have been very supportive about my ambition to pursue a science career. My mum used to be a bone marrow scientist, and she started off as an apprentice like I did!

**Now I'm combining further study with a technician role** at the Viral Vector Core Facility. This is a lab that supports scientists who are creating new vaccines for many different diseases. I help set up experiments involving microscopic viruses and cells. Part of my job is making sure experiments are carried out without mistakes, so scientists can trust the results.

**I'm a friendly and sociable person** so I enjoy the teamwork in a lab. It's crucial to share research and information with other scientists all around the world. My apprenticeship also gave me the opportunity to work in public engagement and improve my public speaking skills.

**I'm excited to find out where my career will lead me.** I am finishing up a life sciences foundation course, and will soon begin a medical biochemistry degree! Hopefully this will lead me into a research role, working out how to turn our growing knowledge of the human body into new medicines and treatments.

### BEST ADVICE?

Work hard towards your goals. At times it may seem difficult and make you want to give up, but pick yourself back up and carry on! It will all be worth it one day.

### HOW DO YOU RELAX?

I like watching movies with my cat, Ginkgo! I also enjoy spending time with my friends. I'm learning how to knit – the furthest I've got so far is making a small scarf!

Foundation course in Life Sciences

Laboratory Technician, Viral Vector Core facility

Apprentice Ambassador for Oxfordshire County Council

Apprentice Laboratory Technician at the University of Oxford

AS Levels

Maths and Science GCSEs



# KALEIDOSCOPIC KITCHEN CHEMISTRY

**Time:** 20 minutes

**You need:** Red cabbage, egg, lemon, absorbent white paper, paintbrush, washable black felt-tip, black permanent marker

## Activity 1. Create a colour-changing painting.

- ✱ Ask an adult helper to chop some red cabbage into chunks and pour hot water over it, as if they were making cabbage tea!
- ✱ When the cabbage tea has cooled down, use it to paint a sheet of white paper purple.
- ✱ Put a little egg white and lemon juice in separate cups. Use them to paint on top of your purple paper, and watch what happens!

## Activity 2. Chromatography cartoons.

- ✱ Cut a small square of absorbent white paper (blotting paper and watercolour paper work well).
- ✱ Use the permanent marker to doodle a cartoon person or animal. Use the washable black pen to add a simple hairstyle.
- ✱ Rest the very bottom of the paper in a shallow bowl of water. Watch as the water soaks up through the paper.

Black ink is made up of a mixture of colours. If the ink is washable, these colours dissolve in water, and get carried different distances as the water soaks up through the paper.

Share your creations at Oxford Sparks:  
[oxfordsparks.ox.ac.uk/justaddimagination](https://oxfordsparks.ox.ac.uk/justaddimagination)

There are lots of opportunities to be creative in a laboratory setting, for example figuring out how to make experiments more effective. For my challenge I'd like you to turn your kitchen into a lab!



## TALKING POINTS

### #1 Change it up

Ask children to paint over the cabbage juice with different fruit juices and foods (always check they are safe to use).

### #2 Investigate

What other chromatography cartoons can your family create? Do all washable black pens produce the same colours?

## ENJOYED THIS? WHAT NEXT?

- Watch Sophie talk about her apprenticeship on YouTube at [bit.do/sophieSTEM](https://bit.do/sophieSTEM)
- Find out more about apprenticeships at [oxfordshireapprenticeships.co.uk](https://oxfordshireapprenticeships.co.uk) and [www.myworldofwork.co.uk](https://www.myworldofwork.co.uk)
- For more ideas, download the Science Museum's Kitchen Science booklet at [bit.do/kitchenscience](https://bit.do/kitchenscience)



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# ANNE MARIE IMAFIDON

## COMPUTER SCIENTIST AND HEAD STEMETTES

Anne Marie's passion for computer science has taken her on an exciting career path from banking to Buckingham Palace. She's keen to help more girls to get creative with code.

**I got into maths and computing by tinkering at home.** My parents aren't from techy backgrounds, but Dad had a computer and he let me play with it. It was really exciting to create stuff like websites and see people use them. I liked taking things apart and putting them back together in a better way.

**I was surprised when I found out that there weren't many women in computer science.** I started STEMettes to inspire girls and women to get into science, technology, engineering and mathematics careers. We've run events for 14,000 girls so far. We're aiming for 2 million!

**Get on the Internet, get on social media, and look for all the different resources out there.** You can research science and engineering careers in the same way you'd research anything. Work experience showed me that there are so many different roles that use tech and maths skills. An internship led to my first role with Deutsche Bank, where I created social media software for people to use at work.

**It's a big misconception that tech careers are boring.** People imagine that we sit in dark rooms staring at screens – but the offices I've worked in are all about glass walls and unlimited chocolate! Studying science and maths leads to all kinds of crazy things. I travel all the time and even met the Queen a couple of years ago.

**Careers in technology are as creative as careers in the arts.** You start with a blank canvas and use basic pieces to create something new. Your creation might be an app like Instagram. Or it might be something that helps solve a real world problem, like designing seatbelts that save lives.

**I don't know what I'll be doing in five years time, but it will be cool.** I want to keep on solving problems and change lives in my own little way.

Cofounded STEMettes and Outbox Incubator

UK Young IT Professional of the Year

Worked for Deutsche Bank

Internships at Goldman Sachs, Hewlett-Packard, Deutsche Bank and Lehman Brothers

Studied Mathematics and Computer Science at the University of Oxford

### BEST ADVICE?

Don't be afraid to push boundaries and just do stuff! Following every rule doesn't lead you anywhere magical.

### HOW DO YOU RELAX?

Most of my downtime is spent watching TV – anything funny. I probably watch more than you'd expect!



# STEMettes

♥ ★ # +



# GET CREATIVE WITH CODE

**Time:** 20 minutes

**You need:** Just a web browser

## Activity 1. Hack the news.

- \* Visit the website [goggles.mozilla.org](http://goggles.mozilla.org) with your adult helper and activate Goggles (it's really easy).
- \* Go to [www.bbc.co.uk/newsround](http://www.bbc.co.uk/newsround) and click the Goggles button in your toolbar to turn them on.
- \* Click on any text or picture to start tinkering with the code! Can you make a version of the news all about your friends and family?

## Activity 2. Rework your school website.

- \* Go to your school website. Click the Goggles button in your toolbar to turn them on.
- \* Click on any text or picture on the school website to start tinkering with the code.
- \* What will you change to make the site even better?

The best way to learn about coding is to play around with code. There are free resources online that make this easy. X-Ray Goggles is one of my favourites. It lets you remix the code from your favourite web pages to create something new. You don't need any coding experience – just get stuck in.



## TALKING POINTS

### #1 Trial and error

The effects of changes can be seen on screen instantly. This is a great way to learn what each bit of code does.

### #2 Have fun!

Playing with a favourite website makes the activities feel personal. Children can create their own photo galleries, comic books, birthday cards or games using code.



Don't worry – no one else will be able to see your hacks. You're only changing a version of the site stored on your computer. You can publish your creations on the Goggles website by clicking 'P', but this still won't change the real news.

Share your creations at Oxford Sparks:  
[oxfordsparks.ox.ac.uk/justaddimagination](http://oxfordsparks.ox.ac.uk/justaddimagination)

## ENJOYED THIS? WHAT NEXT?

- Look out for STEM events in your area at [www.stemettes.org/girls](http://www.stemettes.org/girls)
- Sign up to the free Scratch website at [scratch.mit.edu](http://scratch.mit.edu) to keep developing your coding skills or try [scratchjr.org](http://scratchjr.org) and [thimble.mozilla.org](http://thimble.mozilla.org)
- Visit [coderdojo.com](http://coderdojo.com) and [www.codeclub.org.uk](http://www.codeclub.org.uk) to find out about coding clubs for children near you.



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## ROMA AGRAWAL

### STRUCTURAL ENGINEER

Roma describes her journey from stickle bricks to the top of The Shard, and inspires you to get engineering with everyday objects.

**I took an unusual route into engineering.** I enjoyed maths and science in school, although I found some bits harder than others! I knew that I wanted to do something scientific but I didn't know exactly what, so I studied Physics at university to keep my options open.

**My mum and dad played a big role in developing my career interests.** We played with Lego and construction blocks all the time. I loved assembling the small pieces to create something large and meaningful. Now my job allows me to do that everyday! I was part of the team that designed and built The Shard in London, the tallest skyscraper in western Europe.

**I didn't realize how much teamwork there would be in engineering.** Everything is teamwork – putting together a building or a bridge is not something anyone can do alone. I'm always working with people from different backgrounds, which is exciting and fun.

**Studying maths and physics is important in becoming an engineer, but you don't have to be a genius at those subjects.** Being an engineer combines many skills. I am very organized, and good at communicating in meetings. I love sketching and doing presentations too.

**My work makes a big difference in a city's landscape.** My work on The Shard will have a lasting impact on London's skyline. I've also designed over 500 flats in London, much needed as there is a housing crisis in the capital.

**You don't have to aim to change the world in order to change the world!** Think about all the times in everyday life you say 'Why can't we do this?' or 'I wish it was easier to do this'. Engineers bring real change by trying to solve these problems.

Construction company

Engineering firm

Masters Degree in Structural Engineering, Imperial College London

Degree in Physics, University of Oxford

Maths, Further Maths, Physics and Design and Technology A-levels



### BEST ADVICE?

Ignore all the unhelpful stereotypes and do what you enjoy. Science and engineering careers are far more wide reaching than any of us appreciate.

### HOW DO YOU RELAX?

I love travelling and baking cakes. I'm writing my first book, and I also love classical Indian dance. I started dancing when I was 6!

The Shard





# ENGINEERING WITH EVERYDAY OBJECTS

**Time:** 30 minutes

**You need:** Scrap paper, scissors, sticky tape, paper clips, uncooked spaghetti, elastic bands... you can make structures out of anything!

## Activity 1. Design and make bridges using uncooked spaghetti and elastic bands or sticky tape.

- \* Some shapes are stronger than others. Experiment with triangles, squares and arches. Try combining shapes in your final design.
- \* Bridge the gap between two books or two chairs.
- \* Test your bridges by adding weight gradually. Can you improve your designs?

## Activity 2. Build skyscrapers using scrap paper, scissors and paper clips.

- \* Sketch your designs first. Work out how to make them real.
- \* Work together to build a ceiling-scraper... or challenge each other to build the highest tower possible with a single sheet of paper!
- \* Can you add a striking spire, like the one Roma helped create for The Shard?

It's my job to create the skeleton that makes a building stand up, and to make sure structures are safe to live and work in.



## TALKING POINTS

### #1 Experiment

Changing the shape of a material can make it stronger – whether it's steel or spaghetti. Experiment with different shapes. Talk about what you discover.

### #2 Teamwork

Engineering is all about teamwork. Combine your ideas to create structures that are beautiful and strong.

You don't need special construction kits to design and make at home. Raid the recycling box, or get creative in the kitchen.

## ENJOYED THIS? WHAT NEXT?

- You'll find more activities for 7–11 year olds at [www.youngeng.org.uk](http://www.youngeng.org.uk) Membership is free!
- Find out more about engineering careers at [www.tomorrowsengineers.org.uk](http://www.tomorrowsengineers.org.uk)
- Look out for Roma's book about engineering, called *BUILT* (Bloomsbury, 2018)

Share your creations at Oxford Sparks:  
[oxfordsparks.ox.ac.uk/justaddimagination](http://oxfordsparks.ox.ac.uk/justaddimagination)



# DAVID GAVAGHAN

## COMPUTER SCIENTIST

David was the first person in his family to go to university. His childhood love of maths led to a career that is changing the way scientists develop new medicines.

I grew up in Blackburn, in the north of England. The butcher next door used to give me sums to do for fun, and I got a reputation for being good at maths. It came naturally to me, and I always enjoyed it.

**My family gave me lots of encouragement and support.** My dad was a turner who made parts for machines. Later on he became a teacher. He would go and learn extra maths so he could help with my school work into my teens.

**Maths is the language of science.** Everything from mobile phones to aeroplanes is designed and built following rules that can be described using maths. Living things are more complicated than phones and planes, but we can still use maths to figure out how they work. I work with scientists and doctors to understand the rules underlying living systems, such as the heart.

**If we know these rules, we can programme computer models** that predict what will happen when something changes – for example, how a new medicine will affect a person's heartbeat. Medicines with dangerous side effects can be ruled out at an early stage, without ever having to test them on people.

**It's a fantastic feeling to predict the results of an experiment,** visit the lab and see that you got it right. But the most important part of my role is education. I enjoy training the scientists of the future, and showing them what maths can do.

Professor of Computational Biology

Set up the Computational Biology Group in the Department of Computer Science

DPhil from the University of Oxford

Masters in Mathematical Modelling from the University of Oxford

Mathematics degree from Durham University

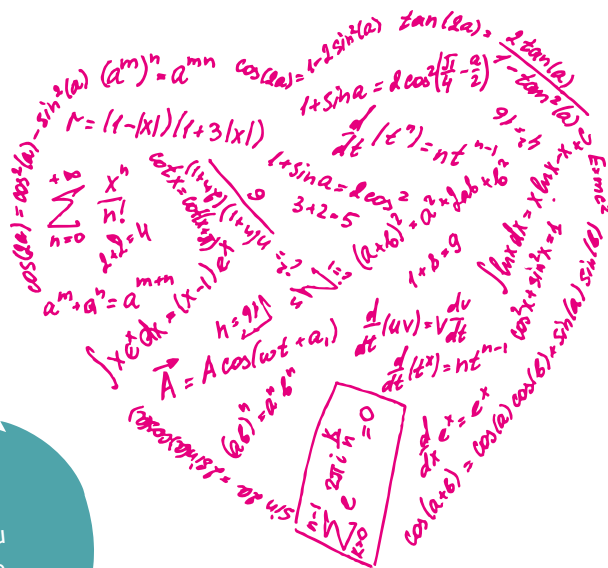


### BEST ADVICE?

Stick with maths. The stuff you do at primary school is just the building blocks – even more interesting stuff comes later.

### WHAT MAKES YOU PROUD?

My Football Association Level 1 coaching badge! I enjoy coaching my son's football team here at the university.





# TEACH A COMPUTER TO DOODLE

**Time:** 30 minutes

**You need:** Lego bricks, a computer or tablet with an internet connection.

## Activity 1. Practise giving instructions.

- \* Sit with your back to a partner, so you can't see each other's hands. Each person needs an identical set of 10 Lego bricks.
- \* Create a model with the bricks. Then give your partner step-by-step instructions to build the SAME model.
- \* Compare your creations to find out how good your instructions were!

## Activity 2. Invent your own doodles by playing with code.

- \* With an adult helper, use the free software at [code.org: studio.code.org/s/artist](https://code.org/s/artist).
- \* Drag and drop the blocks to build the code below. It tells the computer how to draw a square.
- \* Invent your own doodles by playing with the code. Work together to turn your ideas into simple instructions that a computer can follow.



Mathematical modelling starts with questions and suggestions from different people. It's a team effort and really good fun.



## TALKING POINTS

### #1 Keep trying

Reassure your child that they are not supposed to work it out the first time. Coding is a process.

### #2 Brainstorm

Work with your child to brainstorm and make suggestions. Teamwork makes it even more fun.

## ENJOYED THIS? WHAT NEXT?

- NRICH has lots of free and exciting maths activities for children of different ages: [www.nrich.maths.org/frontpage](https://www.nrich.maths.org/frontpage)
- The Primary Maths Challenge encourages enthusiasm and boosts confidence in mathematics – why not ask your school to get involved? [www.primarymathschallenge.org.uk](https://www.primarymathschallenge.org.uk)
- [www.mathszone.co.uk](https://www.mathszone.co.uk) has hundreds of free online puzzles and games.

Share your creations at Oxford Sparks:  
[oxfordsparks.ox.ac.uk/justaddimagination](https://oxfordsparks.ox.ac.uk/justaddimagination)

'Coding' means speaking to computers by giving them instructions in a language they understand.



# SUNETRA GUPTA

## EPIDEMIOLOGIST AND NOVELIST

**Sunetra has forged successful careers as both a scientist and a writer. She describes how her curiosity and creativity feed into her research into infectious diseases.**

**I was always curious about how things work**, but I only started enjoying school maths and science when I was about 14 years old. It's a journey, and the stuff you learn first is just the nuts and bolts. Once I got started it came as a surprise that maths was really interesting!

**My parents didn't work in science** – my father was an historian – but they showed me how to be curious and interested. This gave me the courage to do what I wanted to do. I liked arts and sciences equally, but I chose science A-levels to keep my options open.

**Epidemiologists study diseases.** I use maths and experiments to work out how viruses and bacteria evolve. The virus that causes flu changes all the time, which means that last year's vaccine may not work this year. My team is working on a new type of flu vaccine that could help to solve this problem.

**Our work could have a huge impact on human health.** This is very motivating but at the same time, you are not expected to solve these problems on your own. It takes the work of a lot of scientists to arrive at a solution.

**As a scientist, my job is to come up with new ideas to test.** My interest in stories, poetry, drama and art helps me to think about problems in new ways. I always wanted to do something very stimulating and creative, and I am fortunate that all those expectations have been met!

**The Department of Zoology is a friendly and supportive place to work.** I was always able to take my children into work, and to work flexibly. Now that I'm a Professor, I have lots of responsibilities, including mentoring students. I work very closely with a fantastic team, and this is intensely rewarding.

Professor of Theoretical Epidemiology, University of Oxford's Department of Zoology

Junior Research Fellow, Merton College, Oxford

Wellcome Trust Training Research Fellow

PhD in theoretical epidemiology, Imperial College, London

First degree at Princeton University, USA

### BEST PART?

Working in science is like being ten years old forever, and going on an amazing adventure. I still wake up every day with a sense of excitement and wonder.

### HOW DO YOU RELAX?

I love writing books, cooking, gardening, reading, watching films... just living life to the full!



# MAKE ART INSPIRED BY SCIENCE

**Time:** 30 minutes

**You need:** Web browser, paper and pencils, art materials

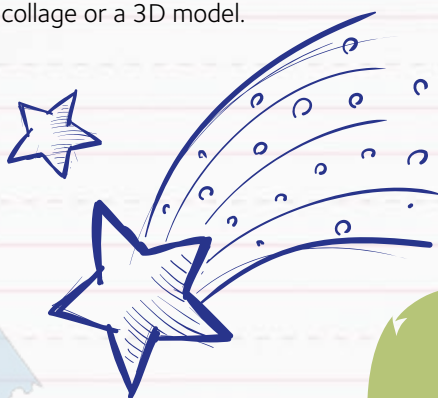
## Activity 1. Create a cartoon.

- ★ Visit [www.shooting-stars-women-scientists.com](http://www.shooting-stars-women-scientists.com) with an adult helper. Sunetra uses comic conversations to tell the stories of some brilliant scientists.
- ★ Use books or the internet to find out more about a scientist, inventor or engineer – it could be anyone you like.
- ★ Create your own cartoon or comic strip about the person you selected, and share it with other people.

## Activity 2. Make art inspired by the tiniest living things.

- ★ Sunetra studies living things that are too tiny to see without a microscope. Take a look at pictures of the flu virus at [www.bigpictureeducation.com/influenza-images](http://www.bigpictureeducation.com/influenza-images) (this is a free Wellcome Trust resource).
- ★ Make a piece of art inspired by the pictures. It could be a drawing, a painting, a collage or a 3D model. Be as creative as you like!

Spend time  
reading, writing  
or doing drama.  
It can all feed into  
a science career.



I love stories, poetry, drama and art. I worked with an artist to write Shooting Stars, a website that celebrates the stories of remarkable women scientists.



## TALKING POINTS

### #1 Be curious

If something sparks your child's interest, help them find out more about it. There is no need to wait until it's covered at school.

### #2 Be creative

Remind your child that science is not about remembering facts or passing tests, it's about thinking and solving problems.

## ENJOYED THIS? WHAT NEXT?

- Visit the Museum of the History of Science in Oxford to marvel at microscopes.
- Learn more about microorganisms on this interactive website: [bit.do/microorganisms](http://bit.do/microorganisms)
- Find out how big (or small) microorganisms are by playing with these interactive scales [bit.do/cells-scale](http://bit.do/cells-scale) and [bit.do/cellsalive](http://bit.do/cellsalive)

Share your creations at Oxford Sparks:  
[oxfordsparks.ox.ac.uk/justaddimagination](http://oxfordsparks.ox.ac.uk/justaddimagination)



## JUST ADD IMAGINATION

Creative science and maths activities  
to inspire imaginative futures



# DEAR PARENT

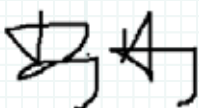
This resource is part of the Parents for STEM Futures project, created by the Mathematical, Physical and Life Sciences Division of the University of Oxford.

We'd like to get primary school children and their parents excited about science, technology, engineering and mathematics (known as 'STEM').

Parents play a vital role in helping their children to identify future roles in which they can be happy and successful, and you don't need a background in STEM to explore these opportunities together. In this resource you'll find ways to help your child link school science and maths with a career that fits their personality and interests.

There are fun, creative activities to do together, as well as talking points to help you get chatting about science and maths at home. If something sparks your child's interest, there are links to help you find out more. You'll also find interviews with eight people from very different backgrounds, who show that science and maths isn't just for one type of person, but leads to exciting opportunities for everyone.

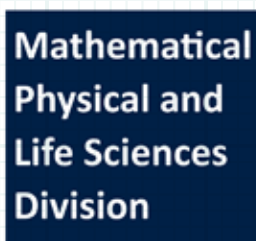
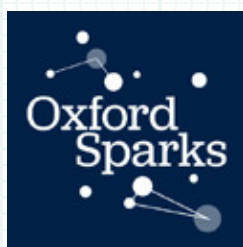
We hope you have fun exploring the resource!



**Daisy J. Hung**  
Equality and Diversity Facilitator



**Michaela Livingstone-Banks**  
Public Engagement Facilitator



**Written by:** Isabel Thomas  
**Designed by:** University of Oxford Design Studio

The links in this book were all correct at the time of printing, however content on the internet can change quickly. We recommend that you always supervise your child when they are accessing content online, and visit [childnet.com/resources/know-it-all-for-parents](https://childnet.com/resources/know-it-all-for-parents) for more advice on helping your child to stay safe online.

You can find us online at:  
**[oxfordsparks.ox.ac.uk/justaddimagination](https://oxfordsparks.ox.ac.uk/justaddimagination)**