

MEDICAL

# Mavericks World

Helping students discover amazing opportunities in the world of health, medicine & STEM.

Autumn 2023

#BEMOREMAVERICK

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## Your Medical Mavericks World Creators



**Tom Warrender**  
Tom is the founder & Head Honcho of Inspiration at Medical Mavericks. His specialism is Physiology & Toxicology.



**Victoria Hayden**  
Victoria delivers our workshops at schools and events, has a degree in Sports and Exercise Science and a Masters in Sports Biomechanics and Technology.



**Hattie Adley**  
Hattie also delivers our workshops, has a degree in Biomedical Science and is starting a Masters in Paramedic Science.

# The Hypothalamus

## - your body's thermostat!

By Tom Warrender

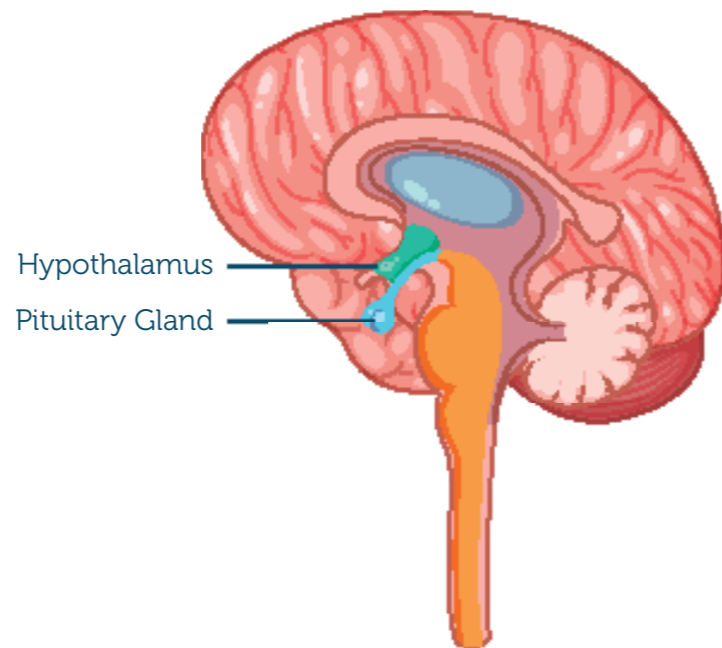


**W**inter is almost here and that means someone in your house might have put the central heating on to keep the house warm. But did you know that your body has its own thermostat to control the temperature of your body in all the different scenarios and environments we put ourselves in? It is called the HYPOTHALAMUS and it is found deep inside our brain!

Humans are hot blooded, which means they generate heat from all the metabolic processes and reactions that happen in our body. Our ideal temperature is 37°C. This ideal for all our reactions and processes to work properly.

Any colder or hotter than 37°C will start to affect how our normal body processes work. For example if our temperature gets too hot, enzymes in our cells can start to change shape and not work as they should! If our enzymes don't work, we can't make energy and our cells stop working!

So, our hypothalamus keeps a close eye on the temperature of our blood as it flows through it, constantly checking if it is 37°C.



Have you ever seen your parents put their hand in the bath to check the temperature of the water...your hypothalamus is a bit like that, but it constantly checks the temperature of your blood. It also receives information from temperature sensors (thermoreceptors) in your skin too!

### Feeling Cold?

When the temperature outside plunges, the hypothalamus jumps into action. It detects the cold through thermoreceptors that constantly relay temperature information. As a response to the cold, the hypothalamus triggers a series of physiological changes to keep us warm!

First up is vasoconstriction, where blood vessels near the skin's surface constrict (get smaller). This helps reduce heat loss as our blood is no longer near our skin where it is cooler. Keeping blood deeper inside our body, keeps the blood warm! This is why you also look pale / blue in the cold, because your blood is being diverted away from your skin, so you lose your pinky / red colour!

The hypothalamus also activates the shivering mechanism. Here's how it works: It sends signals to your muscles making them contract and relax rapidly, a process that generates heat through burning energy and friction! Moreover, it communicates with

the endocrine system to release hormones like thyrotropin-releasing hormone (TRH) which further aids in heat generation by increasing our metabolism. When we burn more energy, we generate more heat!

Did you know that if you travel to the antarctic, you need around 5,000 calories a day compared to 2,000 in normal climates. This is because your body needs to burn the extra calories to keep you warm!

### Feeling Hot?

In a hot environment, the hypothalamus sets off different mechanisms to cool the body. It triggers vasodilation, a process in which blood vessels expand, especially those near the skin, so the heat in your blood can be transferred to the environment.

This is helped by sweating, which is also triggered by the hypothalamus. It stimulates sweat glands, causing an increase in sweat production. As sweat evaporates off the skin's surface, it carries away heat, thus cooling the body.

### Fever: A Heated Response to Infection

However your hypothalamus can be turned up just like your central heating. Instead of checking for 37°C, it can be reset to check for a higher temperature. This is what happens when you have a fever, also known as pyrexia.

During an infection, substances known as pyrogens are released. Pyrogens make their way to the hypothalamus, altering its set point for temperature regulation. They turn the

thermostat up so now your hypothalamus is checking for that higher temperature.

Because your blood would be 37°C at this initial point, the hypothalamus does everything it can to elevate the body's temperature to the new 'normal'.

So, when you are ill and you feel cold and get the shivers, your hypothalamus has been turned up and it thinks your blood and body are too cold. How does the hypothalamus warm you up? Yep, it gets you shivering!

This is not a futile exercise; the raised temperature assists in supporting the immune system to combat invading pathogens. The biochemical processes of harmful microorganisms are disrupted at higher temperatures, and the immune system's functions are enhanced.

As your body temperature increases and helps fight off the infection, the pyrogens are

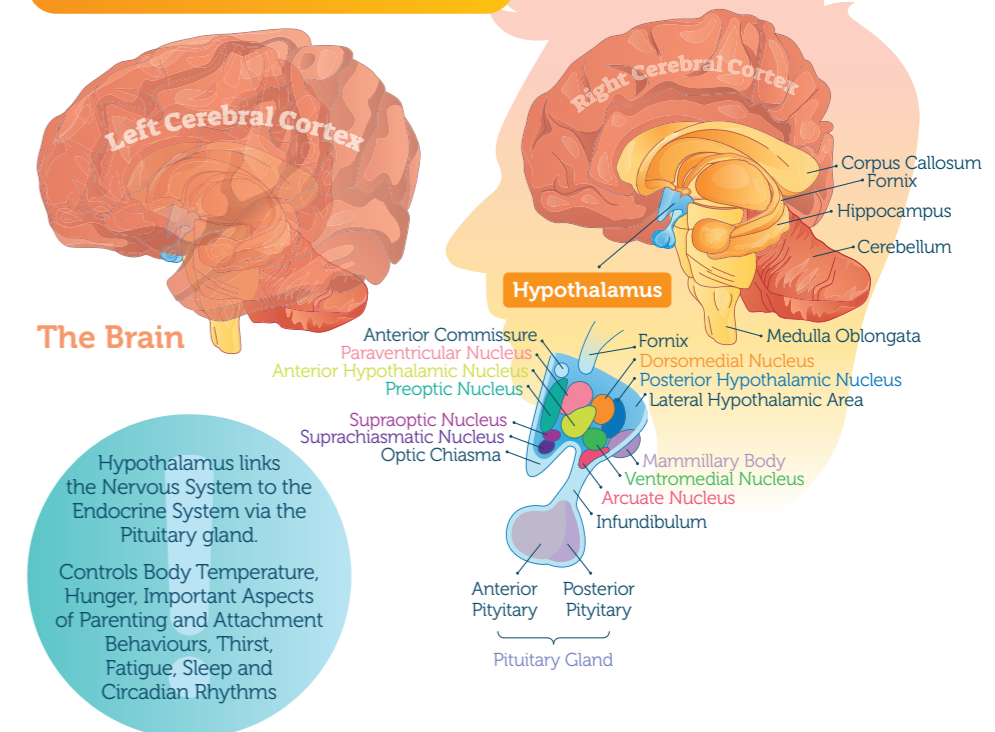
removed and your hypothalamus is turned back down to 37°C. Because your body is above 37, your hypothalamus triggers the mechanisms that cools you down... opening your blood vessels near your skin that make you redder and it also makes you sweat!

A word of warning though. Babies, young children and the elderly can't control their temperature as well as adults so their temperature needs to be checked regularly. If it goes too high they could dehydrate or in the worst case, have a seizure!

This is where drugs like paracetamol come in. They block the enzymes that make the pyrogens so the body can't make them and as a result your hypothalamus isn't turned up and resets to 37°C!

It's a pretty awesome mechanism controlled by a tiny part of your brain!

## Hypothalamus



# A-Z of Medical Careers

By Hattie Adley



## Dermatologist



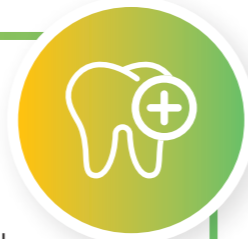
**D**ermatology is a specialism within the branch of medicine, so to do this you must be a doctor. This field is incredibly wide ranging with over 2,000 different skin conditions including common conditions such as eczema all the way to fish scale disease! Alongside diagnosing skin conditions,

dermatologists can be involved in taking biopsies, using UV light therapy, performing intralesional injections or even cryosurgery for cancer lesions.

Typically, to get into dermatology, you will need 8-9s at GCSEs and 3 A levels at A-A\* and a degree in medicine. Following the two-year foundation programme as a

junior doctor you can apply for dermatology training which will take a minimum of six to seven years. As a dermatologist you can further specialise in surgery, paediatrics, allergens, photodermatoses, hair and nails. You could work within primary care at GP surgeries or located in a hospital. Dermatology has plenty of variety!

## Dental hygienist



**D**ental hygienists are usually found in dental surgeries looking after both adults and children's teeth and gums by performing scaling and polishing teeth and applying topical fluoride and fissure sealants. However dental hygiene can become very exciting when working in hospitals helping patients who have undergone major surgery and may require orthodontic treatment.

To become a dental hygienist, you need five GCSEs at a level 4-9, two to three A levels or a recognised dental nursing qualification to get onto a dental hygiene course approved by the General Dental Council. This course will include studying anatomy and physiology and dental pathology, preventative dentistry to maintain good oral health alongside how to manage and care for patients. You can even get a £5,000

bursary if you start a dental hygiene course at level 5 or 6 at university which you don't ever have to pay back! In this job role it is possible to progress to manage dental practices, teach other dental hygienists or even work as an orthodontic therapist.

## Dental nurse



**D**ental nursing is a hugely varying career working within the dental team helping dentists, clinical dental technicians, hygienists, therapists and can help treat patients of all ages. Nursing within dentistry is a clinical role to reassure them throughout receiving treatment. They work very closely with dentists to aid and support the smooth running of practice. Dental nurses require a lot of tact as many patients are anxious when receiving dental treatment and most importantly be able to work amazingly well in teams.



To become a dental nurse, you can work as a trainee dental nurse you do not need any academic qualifications, however, to become a qualified dental nurse you must study a dental nursing course that is approved by the General Dental Council.

To study this course, you will need a minimum of 2 GCSEs including English language and maths or science. Dental nursing courses may require A-levels or equivalent to enter onto a full-time university degree, alternatively, a level 3 apprenticeship in dental nursing is a great way to gain this qualification! With further training, dental nurses can be involved in performing x-rays, clinical photography or impression-taking entering the dental public programmes.

## Dental therapist



**D**ental therapy may be the role for you if you enjoy independence and patient contact. As a therapist you can perform routine dental work including scaling and polishing, applying fluoride and fissure sealants, taking x-rays and impressions, crowns, and extraction! This role often involves treating patients who have high treatment needs, for example,

those with learning or physical disabilities, high volumes of untreated dental decay or patients unable to attend regular dental services.

Dental therapy courses require five GCSEs at levels 4-7 and two to three A-levels, or a recognised dental nursing qualification approved by the General Dental Council. With these previous qualifications you can apply for a diploma or degree in dental therapy and be

registered with the General Dental Council. As a therapist you will need patience and interpersonal skills, alongside confidence in your own abilities as you will be working by yourself sometimes. Dental therapists are usually located in dental practices but can work in a hospital or community clinic. With further training you could enter teaching roles or become an orthodontic therapist or even practice manager!

## Dental technician

### What do they do?

- Work with dentists and doctors using a wide range of materials such as gold, porcelain and plastic to design and construct appliances to meet patient needs
- Four specialist areas: prosthodontic technicians (design and make dentures), conservation technicians (crown and bridge work), orthodontic technicians (make

braces) and maxillofacial technicians (based in hospitals or surgeries to help reconstruct patients' faces following accident or injury)

**Career pathway:** with experience can specialise as an orthodontic therapist or via the scientist training programme can specialise in reconstructive sciences.



## Dietician

**D**ieticians are skilled members of the multidisciplinary team implementing scientific and medical research into patient-based practical advice and guidance. Working within hospitals or in the community, you may be helping people who experience digestive problems, those who need to lose or gain weight, patients in mental health wards, people with allergies or even wanting to improve their sports performance. Dieticians can assess, diagnose and treat dietary or nutritional issues and work to promote good health and disease prevention. Dieticians require excellent communication skills as nutrition is often a sensitive topic.



To get onto an approved degree in dietetics, two or three A-levels including chemistry, maths, or biology and five GCSEs at levels 4-9 or equivalent qualifications are required. You can even get a £5,000 bursary at university which you don't ever

have to pay back! A degree apprenticeship is an alternative method to gain this qualification which gives you the chance to also earn a living whilst training. Once qualified, you can join the British Dietetic Association who run courses for continuous professional development. Further training can lead to specialisation in particular clinical areas such as cancer, diabetes, or neurorehabilitation. With enough experience, you can also take on managerial roles to supervise teams of dieticians. This role can lead you to work outside the NHS too.



## Dramatherapist

**D**ramatherapy is a fantastic career for creative minds! If clinical or medical aspects of healthcare do not interest you, working with patients using the healing aspects of drama and theatre may be something you are keen on. Drama therapy is offered to patients of all ages to those who experience emotional, behavioural, or mental health difficulties alongside those with life-limiting conditions or neurological issues. This type of therapy can involve

puppets, masks, or storytelling to aid understanding of social situations, self-awareness, and confidence. Although as a dramatherapist you will be working with patients, this can be in a variety of settings such as the NHS, social services, within education, prisons, or even private practice.

To become a dramatherapist, you will first need a degree in drama or psychological health related subject alongside some experience within therapy or healthcare. To become a registered dramatherapist with

the Health and Care Professions Council, you will need an approved Masters in dramatherapy. This position can also be attained via an apprenticeship, but availability is often limited. With further training, dramatherapists can specialise with certain categories of clients including elderly, offenders, dementia, or palliative care patients. With experience, this position can also lead to consultancy or team management and coordination of therapists from other disciplines such as art and music therapists.



## Diagnostic radiographer

**D**iagnostic radiography is an incredibly innovative area of healthcare involving technology produced in the forefront of medical engineering. Radiography involves looking inside patients' bodies to understand what is going wrong! In this job role you will be taking images of the insides of patients to consult colleagues on diagnosis and treatment plans. The cutting-edge technology used may include 3D CT and MRI scanning! In this position, you work within the multidisciplinary team with

doctors and manage routine patients and patients with major trauma!

To become a registered diagnostic radiographer with the Health and Care Professions Council, you must complete an approved degree or master's qualification in diagnostic radiography. Entry requirements include two or three A-levels including chemistry, maths, or biology and five GCSEs at levels 4-9 or equivalent qualifications. You can even get a £5,000 bursary at university which you don't ever have to pay back! A degree apprenticeship is

an alternative method to gain this qualification which gives you the chance to also earn a living whilst training. With further training you can specialise in sonography or working areas of medicine such as stroke patients or cancer patients. Other positions include research or teaching and progressing to managerial positions. If diagnostic radiography interests you, make sure to have a look at therapeutic radiography!



## Dispatcher



**A**n emergency dispatcher may be the job for you if you fancy a challenge! Call handlers and emergency medical dispatchers work in ambulance control rooms to take calls quickly and calmly from members of the public. This job requires amazing communication skills and the ability to work well under time pressures. Calls may include routine triage systems to decide whether staff and vehicles should be dispatched

or advising patients to see a GP but can involve talking the caller through emergency life-saving procedures such as CPR or clearing airway obstructions. In the ambulance control room, there is a multidisciplinary team including clinically trained healthcare professionals: doctors, nurses, and paramedics.

There are no set qualifications required to enter this job role, however, the ambulance service will require a good standard of literacy, numeracy

and IT skills alongside tactful communication and keyboard skills! There are opportunities for progression within this field such as becoming a team leader in charge of a team of call handlers or a manager responsible for the call centre during the shift. Related roles include emergency care assistant, ambulance technician or paramedic. This job entails a 37.5hr shift pattern including evenings, days, nights, and bank holidays but is a very rewarding job.

## District nurse



**D**istrict nurses help a variety of people, young or old, recently discharged, terminally ill or physically disabled patients. This role involves visiting patients in their home or in residential care to provide complex care that the patient or family members cannot perform on themselves. Such tasks may include assessing the needs of both the patient and their families, performing clinical procedures, monitoring care received by the patient and being accountable for service delivery. These nurses must have great

adaptability and resourcefulness to accommodate changes in circumstances enabling the required care to be given appropriately. Being a healthcare professional in your patient's home often requires confidence as these environments can be challenging. This role is essential to keep re-admissions low by enabling patients to stay in their own homes or places of residency.

To become a district nurse, you need to be a registered adult, mental health, paediatric or learning disability nurse to apply for this speciality. The district nurse training programme

is at degree level including 50% theory and 50% practice in areas of clinical nursing, practice development and leadership alongside care and programme management. This is also available via a level 7 apprenticeship. This role, with experience, could also lead to becoming a community matron or working within education, research, or mentorship. This job entails a 37.5hr shift pattern including evenings, days, nights, and bank holidays but is a very rewarding job.

# How the NHS is Split Up – Part 1

By Tom Warrender



**With around 350 jobs to choose from in the NHS, it can be tricky to know where to start looking for your dream role. Yes, everyone knows about doctors, surgeons, dentists and nurses, but what about everything else?**

**T**his article is the first part of the perfect guide to show you how roles in the NHS are split up and grouped together in different sectors. Plus we'll even introduce the non medical roles, just in case you don't fancy working with patients or with blood or in a lab!

Take the non medical roles in the NHS. These would include cleaners, caterers, chefs, porters, drivers, HR (that's human resources and they sort contracts and make sure everyone is ok to work!), legal teams, accountants, Chaplains and religious leaders, receptionists, office workers, gardeners, architects, maintenance workers, caretakers... we could go on! All of these work in the NHS and are found in the sector called **WIDER HEALTHCARE TEAM**.



Up next is the **ALLIED HEALTH PROFESSIONS**. You might have heard of some of the roles in this sector. Paramedic and Physiotherapist are two examples. We also have podiatrists (feet!) speech and language therapy, radiographers and dieticians. You can even support patients in surgery as an operating department practitioner.

However, there are several roles that are classed as therapists that support patient's mental health. They include art therapist, drama therapist and even a music therapist! How awesome is that? Using the arts as a way to treat and care for patients with mental health issues!

NHS Departments

I'm sure you have heard of a paramedic, but they need a great team behind them to make sure they know where they are going, what the next emergency is and help re-stock the ambulance! This is where the **AMBULANCE SERVICE TEAM** comes in.

You have call handlers who are trained paramedics, but they take the 999 calls! On an ambulance you might also have emergency care assistants. They are not trained as highly as a paramedic, but they'll support them in all sorts of emergency situations and help re-stock the ambulance.



Next up is the **DENTAL TEAM**, that includes a dentist, but there's also the dental hygienists and therapists that can check gum health and clean up your teeth. You also have the dental nurses that support all of the dental team in procedures and are responsible for instruments used in procedures and look after patient records.



One of the most important groups in the NHS are the **HEALTHCARE SUPPORT WORKERS**. They are like the link between all the other roles and the patient.

This is not just one role. You can be a healthcare support worker and have different specialisms. For many people in the NHS, this role can be a stepping stone into the career they are supporting or someone's first experience of a role in the NHS.



SPECIFIC ROLES ON NEXT PAGE! →

You have healthcare support workers for dieticians, maternity, radiography, physiotherapy, podiatry and prosthetics! Other specialisms include mammography for finding breast cancers, orthotics for creating shoe inserts and occupational therapy for supporting patients who struggle with daily tasks.

One of the most common roles in this area you will see is a healthcare assistant or HCA. They work across lots of medical departments but are most commonly found on a hospital ward! Many trainee nurses work part time as a HCA whilst at university!



How these records are stored and kept safe is one of the biggest challenges of the NHS, and health informatics has the responsibility of doing just that!

You have health record departments that look after paper notes, communications technology, IT management and even people that design and look after all the computer programmes!

And finally in this issue, we have Health Informatics!

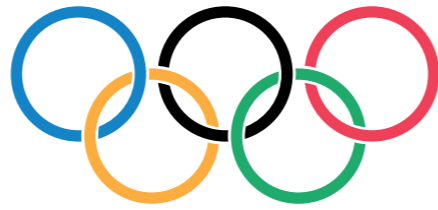
Did you know we all have a set of medical records? These contain all of your medical information from all of your encounters with the NHS from when you were born to where you are today.

Up until about 5 years ago, most medical records were paper based and you would have had a huge folder packed with all the notes from any medical procedures. The more procedures the bigger the folder! However, all our notes are moving to a digital format and can be accessed on a computer.



NHS Departments

# Performance Enhancing Aids and the Olympic Games



By Victoria Hayden

With Paris taking to the world stage on 26<sup>th</sup> July to host the 2024 Olympic Games, athletes across the globe are in their final stages of preparation. But nowadays, to win, they must combine their natural talent with legal preparation methods.

The methods of preparation chosen by athletes, from exercise regimes and nutritional plans to psychological techniques vary considerably; however, all take extensive scientific research and meticulous planning. New ergogenic aids, which are techniques or substances used to enhance performance, are constantly being developed, and they have enabled athletes to achieve ever greater success. Some ergogenic aids are legal, yet others are unsafe and illegal. The difficult question is, how do sport governing bodies agree on what should be banned? When deciding, it is important to ensure that success is still focused on the committed effort and natural skill required, rather than whether athletes have the funding to afford these methods.

**Altitude training** is a popular, legal method of preparation for endurance athletes. This form of specialised training is based on the scientific theory that at altitudes greater than 2500m, where oxygen levels are reduced, the body is stimulated to produce more red blood cells, meaning that more oxygen can be carried around the body. Use of altitude chambers have also grown, and scientists in Finland have even designed a 'high-altitude house' for athletes to live and sleep in! This is now being used by thousands of

cyclists and triathletes around the world. This research would be conducted by **Performance Analysts**.

Several altitude training strategies and devices have undergone critical review by the World Anti-Doping Authority, with the view of potentially banning them as illegal performance-enhancing methods. Since 2000, the International Olympic Committee has even prohibited the use of simulated altitude devices within the Olympic village.



**Glycogen loading** is a second legal method athletes may use to enhance their performance. Firstly, athletes deplete their glycogen stores through intense exercise before eating a diet high in carbohydrates. This is super compensated by the body, meaning that they have more energy for a competition. How diet and supplements can enhance performance, recovery and health is investigated by **Sports Nutritionists**.

Sometimes athletes have broken the rules on what performance-enhancing substances are allowed. In 1998, Ben Johnson won the 100 metres at the Seoul Olympics. He was later disqualified and stripped of his medal when it was discovered he had used an illegal performance-enhancing drug, stanozolol. More recently, Russian athletes were involved in a doping scandal and banned from the Olympics and global sporting events.

**Specialist equipment or clothing** can also be used to improve performance. Such as lightweight, aerodynamic bicycles, and clothing materials that reduce air resistance. In 2008 at the Beijing Olympic Games, Michael Phelps wore the LZR Racer, a polyurethane Speedo swimsuit designed by the Australian Institute of Sport, and the wind tunnel testing facilities of NASA. The suit improved his performance by reducing drag, although it did take 20 minutes to put on!

At the same Olympic Games in 2008, 25 swimming world records were broken ... 23 of these were whilst wearing the LZR Racer. In less than one year after its first appearance, 97 world records had been broken at the highest competitive level of swimming! By 2010, the international governing body of swimming banned swimsuits that improve speed, buoyancy,

and performance - including the LZR racer. To design a swimsuit that made athletes so incredibly fast, **sports biomechanics**, would have used mathematics and physics to analyse sports movements.

As you can see, athletes rely on a vast support network, including coaches, performance analysts, nutritionists, and biomechanics. It is the difficult job of **Sporting Governing Bodies**, who implement laws, and **Scientists**, who test samples for banned substances, to keep sport as fair as possible.

The true values of an Olympic athlete are highlighted in the Olympic oath 'We swear that we will take part in these Olympic Games in the true spirit of sportsmanship and that we will abide by the rules that govern them, for the glory of sport and the honour of our country'. Although, in this modern world, is this an idealistic vision when considering the deception that surrounds sports?

However, it is such a narrow line between the boundaries of legal and illegal aids, or do the boundaries need to be revised? Some athletes are calling for a fresh start for sport, with the resetting of the current World Records and making events harder so that results are incomparable.

Who knows what the future will bring? We may be watching sprinters run the 100m in less than five seconds due to newly designed trainers!

But whatever happens, I'm sure the future of sport will not disappoint.



# Interview with Amalia Morris

## - Part 1

### 1st Year Med Student

By Tom Warrender



would need it to go into any STEM type of degree or career. I didn't enjoy Maths that much, I wasn't bad at it, but it wasn't my strongest subject and I only took it because I thought I needed it. By Christmas in Year 12, I dropped it as I was never going to get an A, plus the work I had to put in would have damaged my chances of getting the grades needed in the other subjects. You also don't need Maths for Medicine. In the end I got three A\*'s in my other subjects.

In addition I also did an EPQ which is an Extended Project Qualification. I chose the topic of Ibuprofen, looking at the history of it and even making a version of it in the school lab! We even managed to send it into a university to get it analysed to see how accurate it was! I got an A for this project too.

#### Did you go straight to Med School or take a year out?

I took a gap year because I wanted to apply to Med School with actual grades and not predicted grades. In my gap year I worked for Medical Mavericks traveling all

over the country delivering their workshops and talks to children and young people about careers in the NHS and showing them how to use really cool medical equipment such as an ultrasound. I think I visited every county in the UK!

I worked as a phlebotomist on the bank for my local NHS trust. (A bank in the NHS is a group of people who can come in and work different shifts as and when they want. It is not a permanent position, but gives you some flexibility on when you want to work!)

I also worked in a residential home for children with autism and special needs in a school not far from home.

In the summer I also worked at the Commonwealth Games working as a chaperone on the anti-doping programme! I helped perform drug tests on the athletes that were selected.

Away from in person experiences, I also completed lots of online courses to help with my Med School application.

#### Why Medicine & what other careers did you consider?

I started to make my decision by first of all looking at what jobs I didn't want to do. So I knew I didn't want to have an office job but wanted to work with people and I found the human body fascinating. This led me to roles in healthcare including Paramedics, Nursing, Pharmacology, Physiology & Medicine. I then had to think really hard about where I wanted to go in life and what

I want my job to enable me to do. I wanted the option to be able to specialise in lots of different areas so that removed the Paramedic role. I really wanted to know the depth of science and have a leadership type role in the multi-disciplinary team and be the final person to make decisions. Medicine gave me all of those aspects.

#### What work experience did you have when applying to Med School?

I had a week's work experience at a hospital, but I think the best experiences I had were outside of a hospital! This is because I could work on and develop the key skills Med School looks for in your application. Things like team work, leadership, active listening and communication. I developed all of these working with Tom, especially communication where I'd have

to change how I explained scientific principles to children of different ages and abilities.

That role also helped learn about all the different roles within the NHS and how they are all as important as each other in caring for a patient. The practical element of working for Medical Mavericks also let me use amazing pieces of kit such as an ultrasound which fed my clinical skills bug as did my phlebotomy course. You only have to be 16 and have an English GCSE to attend!

Working in the school for autistic children I learned to communicate in ways that were not just verbal and learn the importance of that. The online courses I completed help show I was going the extra mile to broaden my knowledge during my gap year as I was obviously not studying throughout this period.



**O**ur first interviewee is a fabulous young lady called Amalia Morris - aka as Lily. I've known Lily for 2 years now, but she has known us for a little while longer as we visited her school when she was in year 10!

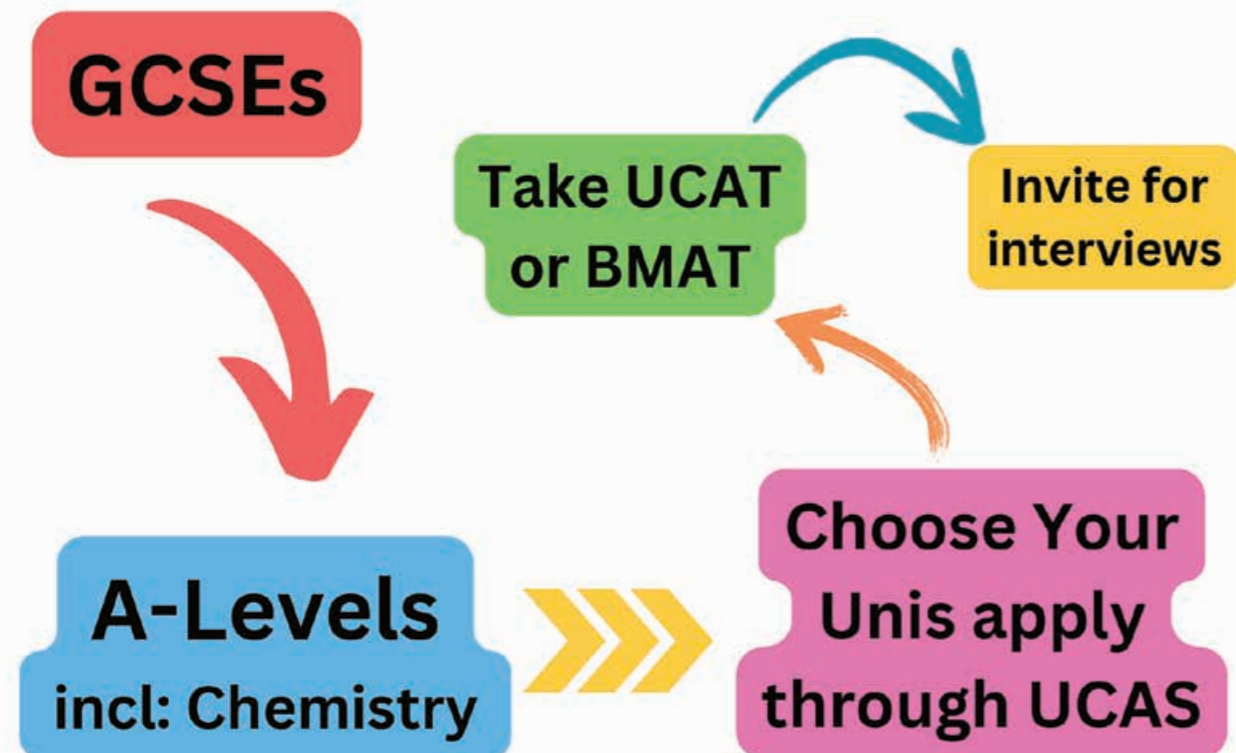
She showed great initiative in looking for work experience and a job, by contacting us directly when she finished her A-levels. We were a little dubious at first because we had never employed a school leaver before.

All of our team were at Uni or had graduated. However, our decision to bring her onboard paid dividends and she became an integral part of our team that we could trust with any project.

Here's the first part of her Med School story. Part 2 will follow in the next issue.

#### What did you study at A-level?

I Initially took Chemistry, Biology, Geography and Maths. I took Maths as I thought I



### How did you find the UKCAT?

I hated it, really didn't like it! I don't think I know any one that enjoyed it! UKCAT stress is a thing that is very real and you will experience it if you do take it. At the time I didn't understand the logic to it, how these questions were going to prove I was going to be a good doctor. But now, in hindsight, I do get it. I can see that you are presented with something that is so foreign that you don't understand but have to persevere, problem solving and critically analysing answers and data. You also have to know when to move on with the questions as they are all worth 1 mark, but some take 30 seconds to answer whereas others will take 5 minutes.

To help with this I did a 1 day course, but what really makes the difference is consistent daily practice!

### Which Universities did you apply for?

Dundee, Newcastle, Exeter & Leicester. I got interviews from all of them, but only attended Dundee, Newcastle and Exeter because Leicester was a tactical back up application as it wasn't in my top 3. In the end I chose Newcastle.

### What were the interviews like?

I had a mixture of panel interviews and MMI, (multiple mini interviews). MMI is very rapid with very little personal rapport building as you only have 6 minutes. Panel interviews were very traditional type interviews with time to get across your personality and the questions were the more common type such as 'why medicine?', strengths, weaknesses... there weren't any role plays in these interviews.

I did a lot of prep for my interviews. I created a document with different sections including GMC principles, the NHS hot topics, strengths and weaknesses, work experiences, why medicine? Why me? And most importantly I did a 'why them' section for each university as they want to know why you want to go there over all the other universities. I wrote all my answers out and then practiced them out loud, because it is really important to be authentic and real. I got my Mum to ask me the questions, had friends chip in too and I also videoed myself answering the questions too.

Thanks for these amazing answers Lily. There are some really valuable nuggets in here, especially around work experience, UKCAT prep and interview practice. We'll have more from Lily next week when she tells us about her 1st year at Uni!

# 3 Episodes of MMTV You Need to See!

Each week we release a new episode of Medical Mavericks TV. We cover all sorts from medical procedures, diseases, careers info, guides to HE and much more. Sometimes we even dress up!



You can watch all our episodes in our student zone. Head over to [www.medicalmavericks.co.uk/for-students](http://www.medicalmavericks.co.uk/for-students) and click MMTV.

Here are three of our favourite episodes.



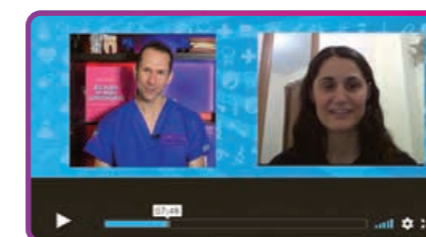
### Episode 31 - How Killing Rats Helped Thin Our Blood

This sounds weird I know, but we use a drug for medicinal purposes that was previously used to kill rats! In fact the chemical in this drug was found accidentally when cows started to mysteriously die in America! The drug we are talking about is Warfarin! Watch this 1st episode of 4 on Warfarin, taken from The Medical Mavericks Academy, where Tom explains more.



### Episode 32 - A Cracking Good Episode

Do you crack your knuckles? If so, you'll love what we have here for you. We have used our ultrasound machine to scan the knuckle joint in Lizzie's hand as she cracks the joint to see what happens! It is very cool indeed!



### Episode 33 - An Interview With A Sports Therapist

Have you heard of Sports Therapy? It is a fab career that is VERY different to Physiotherapy. We interviewed Jo, an amazing Sports Therapist that has worked in all sorts of different sports. She tells us she loves nothing more than seeing a limb pointing in the wrong direction!

See these episodes and more on our YouTube channel. Just Search for Medical Mavericks TV



YouTube

Medical Mavericks TV

# Using Crocodile Blood to Fight Infections!



By Tom Warrender

**I**nfections from bacteria are a huge problem for any species. From a simple insect bite to open surgical wounds, if bacteria get into our body we could be in serious trouble. Luckily we have antibiotics, drugs that can fight off bacterial infections. However, the more we use them, the more likely it is that bacteria become resistant to that drug and it become useless in the fight against infection!

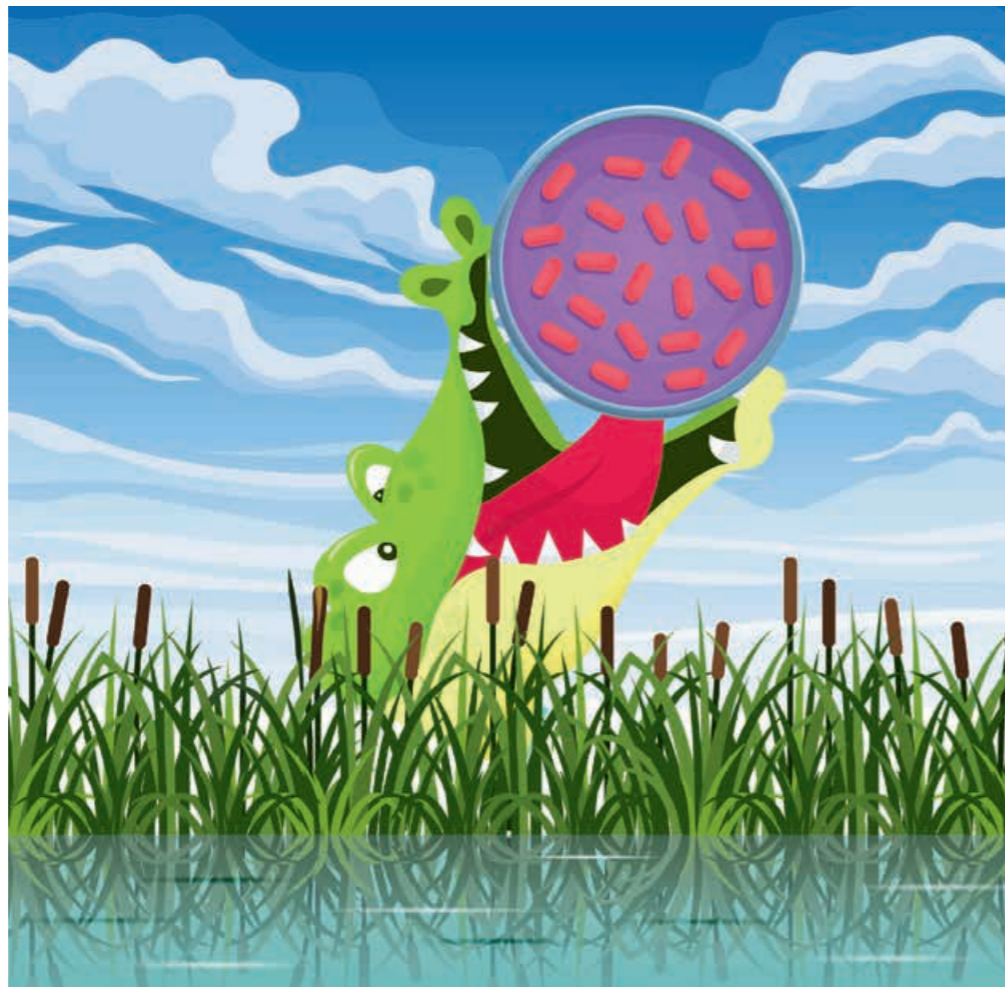
That's why we are always trying to develop new medicines to fight infection and one of the best places to look is mother nature herself! From the mysterious depths of oceans to the rugged terrains inhabited by fearsome predators, the search for potent antibacterial agents is ceaseless.

One such astonishing discovery is 'Crocodillin,' an awe-inspiring antibacterial agent found to originate from a creature as fierce and ancient as time itself - the crocodile. This special molecule is actually a peptide, which means it is a very short chain of amino acids. Amino acids are the building blocks of proteins, but the Crocodillin

chain of amino acids isn't quite long enough for it to be classed as a protein. That's why we call it a peptide.

This fascinating peptide found in crocodile blood has ushered a new dawn in the field of antibacterial research, proving once again that nature holds potent secrets within the most unassuming sources.

Crocodiles, the formidable reptiles known for their tough hides and powerful jaws, have long been a subject of scientific curiosity due to their remarkable immune system. Despite living in bacteria-laden environments and experiencing gruesome injuries, these ancient reptiles exhibit an astonishing ability to avoid infections. This remarkable phenomenon paved



the way for a groundbreaking discovery - Crocodillin, a potent peptide found in the crocodile's blood, exhibiting extraordinary antibacterial properties.

Crocodillin is no ordinary antibacterial agent. It is a robust peptide that has shown formidable action against a spectrum of bacterial strains. Its mechanism of action is as unique as its origin. Unlike conventional antibiotics that target the bacterial cell's machinery, Crocodillin directly targets the bacterial cell membrane - the wall of the bacteria! Damage to the bacteria wall leads to bacterial death. This promising action makes Crocodillin a potential candidate for treating various bacterial infections, particularly those resistant to conventional antibiotics.

However, the journey from discovery to practical application is paved with challenges and requires meticulous research. The structure and functioning of Crocodillin need to be thoroughly understood to harness its full potential. Scientists are keen to explore the scalability of Crocodillin as a therapeutic agent. Its effectiveness, safety, and stability across different environments are essential parameters to establish it as a reliable antibacterial agent in medical applications.

The potential applications of Crocodillin are vast and promising. In a world where antibiotic resistance is a looming threat, Crocodillin emerges as a beacon of hope. Its unique mechanism of action allows it to combat a variety of bacteria,



making it a potential weapon against multi-drug resistant strains. This could revolutionize treatment approaches in healthcare, opening avenues for more effective and resilient antibacterial therapies.

Additionally, Crocodillin's natural origin gives it an upper hand, emphasizing the significance of biodiversity in medical advancements. It serves as a testimony to the hidden gems within the natural world, waiting to be uncovered and utilized for human benefit. The exploration of such natural antibacterial agents is crucial for the diversification and enhancement of our antibacterial arsenal.

In conclusion, Crocodillin, with its fierce and potent

antibacterial properties, symbolizes nature's remarkable contribution to scientific advancement. Its discovery in the formidable crocodile blood is not just a scientific breakthrough but also a tribute to the relentless survival spirit of these ancient reptiles. As research progresses, there's optimism that Crocodillin will pave the way for innovative and potent antibacterial therapies, standing steadfast against the global challenge of bacterial resistance. Thus, the story of Crocodillin reaffirms the belief in nature's extraordinary ability to harbor solutions to some of the most pressing challenges in medical science.

However, I don't fancy trying to fit a cannula and take blood from a crocodile, do you?

# What is an Electromyogram (or EMG For Short!)



By Tom Warrender

**A**n electromyogram (EMG) is a diagnostic procedure used primarily to evaluate and record the electrical activity produced by skeletal muscles (the muscles that are attached to your bones and make you move!),

This powerful diagnostic tool is essential for identifying neuromuscular diseases, evaluating muscle weakness, and understanding the overall health of muscles and nerve cells that control them (motor neurons). An EMG can be used in various fields such as medicine and

sports, significantly contributing to patient care and athletic performance.

## How it Works

During an EMG, a patient or athlete will either have small sticky electrodes placed on their skin or have small, thin needles inserted into the muscle to record electrical activity. The electrodes detect the electrical current generated by muscle cells when they are at rest and contracting. This electrical activity appears as waves on an oscilloscope, and for diagnostic purposes, it can also be heard through a speaker.

## What it Looks At

An EMG primarily focuses on the electrical activity of the muscle. Your muscles are made up of hundreds of muscle fibres with groups of them connected to nerve endings that make them contract. A nerve fibre and the muscle fibres it controls is called a Motor Unit.

When you lift something heavy your brain and nervous system is really clever and it can use or recruit more motor units and muscle fibres to contract and lift the heavy weight. If it is a lighter object, you don't use as many fibres!

We can see this happening on an EMG! The more muscle fibres or motor units that are being used, the bigger the waves on the graph! This information helps in identifying whether the muscle activity is normal or revealing signs of a neuromuscular disorder.

## See your motor units working!

Have you ever watched the World's Strongest Man competitions? Have you seen the events where they have to hold a weight of some kind



for a long period of time in one position? They are not moving the weight, just standing still holding it.

What you tend to see near the end of the event is the athlete shaking as they try and hold on for the last few seconds. This happens because their brain and nervous system is trying to switch between motor units as each one gets tired.

Let me explain some more... When you lift an object you don't use every single motor unit or muscle fibre at the same time. Your body is really clever at switching between motor units as they tire out, giving them time to recover before being swapped over again!

This normally happens really smoothly and you hardly notice it happening, except when you have been holding on to something for a long time! When you see the strong men and women shake, it is their body switching motor units to try and hold on, but it isn't happening very smoothly! They are being swapped very suddenly and quickly which gives that jerky movement we see!

## Who Would Use It

EMGs are commonly used by neurologists, physical therapists, and other healthcare professionals specializing in neuromuscular disorders. They use it to diagnose conditions that cause muscle weakness, spasms, paralysis, or other muscular abnormalities. Athletes and sports professionals also leverage EMGs to optimize their performance and recovery strategies.

## Applications in Sport and Medicine

In sports, EMG is utilized to study muscle activation, basically, is the muscle being 'switched on' by the nervous system and contracting. This helps athletes understand which muscles are being utilized during various activities so they can perform at their very best.

It is also used in biofeedback therapy to improve muscle recruitment patterns and to aid in the rehabilitation of injuries. In this scenario and athlete would be able to see their EMG graph and if it changes when they contract a muscle. When they see a change, they know they are performing the exercise correctly!

**In medicine, EMG is used to diagnose various muscular and neurological disorders such as:**

- Muscle disorders like myopathies
- Neurological diseases like amyotrophic lateral sclerosis (ALS) or polio
- Peripheral nerve disorders like carpal tunnel syndrome or peripheral neuropathies

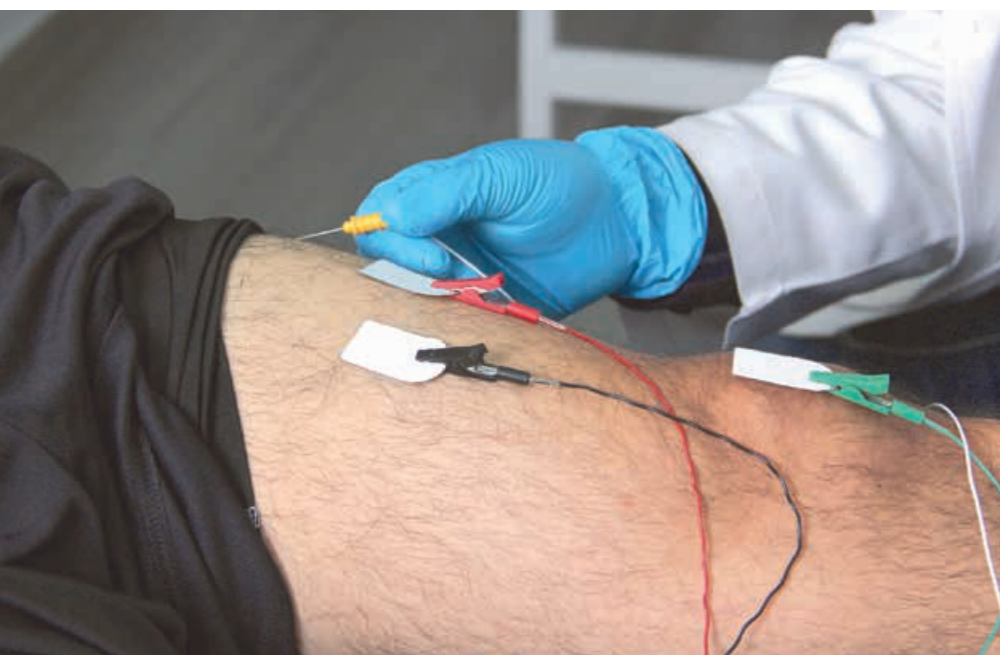
## Types of Diseases it Can Help Identify

An EMG is powerful in detecting various neuromuscular abnormalities and conditions such as:

- Muscular dystrophy
- Inflammation of muscles (myositis)
- Pinched nerves
- Peripheral nerve damage
- Motor neuron diseases
- Disorders affecting the connection between the nerve and muscle (neuromuscular junction disorders)

## EMG Amazing Facts

- EMG can differentiate between muscle conditions and nerve conditions, helping to pinpoint the location of the disorder.
- It can help in determining whether the muscle weakness is due to a neurological disorder or muscle injury, aiding in a more accurate diagnosis.
- In conjunction with nerve conduction studies, EMG can provide a comprehensive analysis of muscle and nerve function.



# Checking lung health with a single breath!

Did you know you can check the health of your lungs with a single breath?

By Tom Warrender



**Y**ep, there is a special test called the Fractional Exhaled Nitric Oxide Test or FeNO for short. It is a really quick and easy test that checks for a gas in your breath called Nitric Oxide. This can tell us a lot about what's going on inside your lungs, but most importantly, it can tell us about what type of asthma a patient might have! Let's take a closer look.

Nitric oxide (NO), a naturally occurring gas produced in our bodies. It can help control blood vessel size as well as how wide your airways are and coordinate your immune system cells. However, in certain conditions such as asthma and COPD, NO levels can increase.

As a result NO gas can be a biological marker, a telltale sign of inflammation and constricted (narrowed) airways we see in asthma. It is particularly heightened when a type of a type of white blood cell called an eosinophil is active and working away in your lungs. These white blood cells are highly active in patients with certain types of asthma that are triggered by allergies. These cells actually trigger some of the symptoms of asthma!



When the test is carried out and NO levels are seen to be high, this is a sign that the patient probably has allergy linked asthma or some sort of inflammation in their lungs. Their airways will be narrowed and swollen as well as having more mucus around them, making it harder to move air in and out of the lungs.

The test is really easy to carry out and involves taking a deep breath in and breathing into the device for between 6 and 10 seconds very slowly and steadily. This is different to peak

flow and spirometry readings where you normally have to blow as hard as you can! The results are pretty much instantaneous as well. We measure NO in 'parts per billion' (ppb) and a score of 40 ppb or more indicates inflammation.

If you ever need to have a FeNO test, there are some foods and drinks you should avoid before the test as they elevate NO levels! These include green leafy veg, beetroot, bacon, caffeine and alcohol! They all contain nitrites that can affect the result.

# 10 Facts about your spleen

By Tom Warrender



Your spleen is an organ you might not have heard much about. You have one of spleen hidden just underneath your ribs towards your back on the left side of your body.

**Here's 10 facts about this very special organ!**

1.

### Blood Reservoir:

The spleen acts as a blood reservoir. In times of emergency, like severe blood loss, the spleen releases this reserve into the system.

2.

### Unique Regrowth:

If part of the spleen is removed (because of injury or disease), it can regenerate to some degree, a unique feature in the human body. However, it won't necessarily return to its original shape and size.

3.

### Fights Infections:

The spleen plays a major role in your immune system. It contains white blood cells that fight infections, especially those caused by bacteria like pneumonia and meningitis.

4.

### Blood Filter:

It is also the body's quality control system for red blood cells. As red blood cells pass through the spleen, it checks them for any issues. Old, malformed, or damaged cells are broken down in the spleen.

5.

### Can Be Removed:

Although it has essential functions, you can live without your spleen. If it gets damaged or needs to be removed (a procedure called a splenectomy), other organs like the liver and lymph nodes can take over many of its functions.

6.

### Fist-sized Organ:

Despite performing several critical functions, the spleen is quite small. It's about the size of a fist and sits in the upper left part of the abdomen, beneath the rib cage.

7.

### Produces Red Blood Cells:

In fetuses, the spleen also produces red blood cells, a job that the bone marrow takes over later in development.

8.

### Animal Differences:

Interestingly, the spleen is much more important in some animals. In fish, for instance, the spleen produces red blood cells throughout their lives!

9.

### Long History:

The spleen has a long history in folklore and ancient medicine. In the past, it was associated with melancholy and bad temper. The term "splenic" (derived from spleen) is still occasionally used to describe a grumpy person.

10.

### Spleen in Sports:

Some contact sports like rugby, American football, or martial arts can risk injury to the spleen due to trauma. That's why it's essential to use protective equipment while playing these sports. Not something you might usually think about, right?

# Disease of the week - Bloom syndrome

By Hattie Adley



## What happens in Bloom syndrome?

- People living with bloom syndrome often have slow growth, are highly sensitive to the sun and they are at a higher risk of cancer.

## What are the symptoms of Bloom Syndrome?

- Onset of this condition usually begins during fetal development in pregnancy or as a newborn.
- Short stature
- Red skin rash appearing on skin exposed to sunlight, usually face, arms and back of hands
- Redness in the eyes from enlarged blood vessels
- Small jaw
- Large ears
- High pitched voice
- Females tend to have low fertility and enter the menopause early
- Males tend to be infertile

## How does this condition occur?

- Rare genetic disorder caused by mutations to a gene called BLM, it is inherited in an autosomal recessive pattern! This means that the gene is located on a non-sex chromosome and that both parents must have a copy of this gene to cause the disorder.
- Genes are a part of DNA that contains basic genetic material, essentially it details instructions for the body on how to make a protein or whether or not to turn other genes on or off

## How is this condition diagnosed?

- Genetic testing for changes to the BLM gene
- Clinical examination for the symptoms

## Are you at high risk of comorbidities with Bloom syndrome?

- Yes. Due to the high instability of DNA in people with bloom syndrome, they have a high predisposition to developing cancers. During DNA repair, instability can cause chromosome breakage and rearrangement. Therefore, it is these genetic mutations that occur during DNA repair that causes cell cycles to change and cells to become dysregulated, leading to cancer development.
- Increased risk of chronic obstructive pulmonary disease, diabetes and frequent ear infections.

## What is the average life expectancy of people living with bloom syndrome?

- 27 years



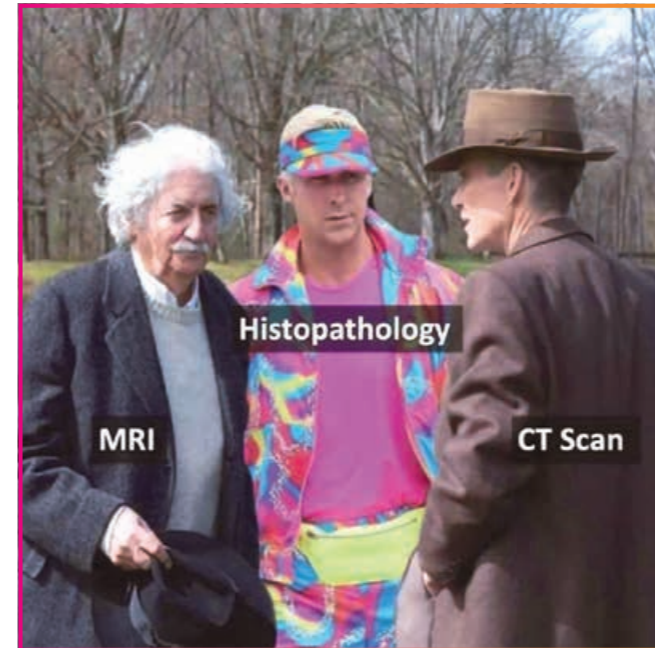
## Interesting fact:

Many conditions that people who live with bloom syndrome develop are associated with aging. This has galvanised people to research whether bloom syndrome results in premature aging. However, bloom syndrome does not cause early grey hair or wrinkles that are normally associated with getting old! But, a particular type of cell called a fibroblast (a connective tissue cell), has been found to enter a state of 'senescence'. This means that the cell arrests, it is the end stage of its living process and will not divide or begin new gene expression or function. This senescence is a part of the aging process leading to the potential that bloom syndrome could be associated with early aging.

### References:

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# We Memes



## Tom's Brain Teasers

Testing what's already in your brain!

I speak without a mouth and hear without ears. I have no body, but I come alive with wind.

ANSWER ON BACK PAGE



# Medical Mavericks' Schools

## ★★ Roll of Honour ★★

Some of the schools we have visited in 2023

### Schools visited (Dec-Feb):

|                                   |                                   |
|-----------------------------------|-----------------------------------|
| Aston University                  | Macmillan Academy                 |
| Audenshaw School                  | Manshead CE Academy               |
| Audenshaw School                  | Mark Rutherford School            |
| Basingstoke College of Technology | Matthew Boulton College           |
| Bately Grammar                    | Mayfield School                   |
| Beamont Collegiate Academy        | Montsaye Academy                  |
| Blacon & Queens Park              | New Durham College                |
| Brighton Hill Community School    | Northampton Academy               |
| Broadway Academy                  | Northampton International Academy |
| Brockington College               | Northfield School                 |
| Cardinal Newman                   | Our Lady of Sion School           |
| Cockburn John Charles Academy     | Outwood Acklam Academy            |
| Corby Technical School            | Padgate Academy                   |
| E-Act Royton & Crompton Academy   | Paxman Academy                    |
| Eastleigh College                 | Rainham Mark Grammar              |
| Edgbaston High                    | Rushden Academy                   |
| Felsted School                    | Ruskin Community High School      |
| Francis Holland                   | Salesian College                  |
| Garth Hill College                | Sheffield Springs Academy         |
| Gateway Academy                   | Shireland Collegiate College      |
| Havant & South Downs College      | Sir William Stanier               |
| Hill House School                 | Stowlawn Primary                  |
| Hodge Hill College                | Telford College                   |
| Hope Valley                       | Tewksbury School                  |
| Hugh Baird School                 | The Henrietta Barnett School      |
| John Spence Community High        | The Moreley Academy               |
| Joseph Chamberlain 6th form       | The Parker E-Act                  |
| Judgemeadow Community College     | The Portsmouth Academy            |
| King Alfred's Academy             | University of York                |
| King John School                  | Walsall Academy                   |
| Kingsthorpe College               | Whitcliffe Mount School           |
|                                   | Whitley Bay High                  |
|                                   | Wigan & Leigh College             |
|                                   | Wolverhampton Girls School        |



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