OXFORD HIGH SCHOOL

THE MEDICAL MYRIAD

VOLUME EIGHT, JULY 2023 | MEDICINE

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INCLUDES:

- Q&A with Doctors and Allied Healthcare Professionals
- Interview with Biotechnology Company
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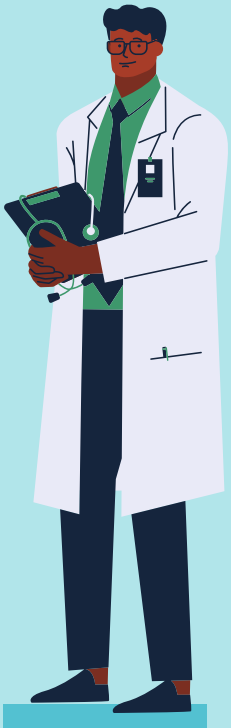


Q&A

WITH IRENE STEINBRECHER, GENERAL PRACTITIONER AT CLIFTON HAMPDEN SURGERY INTERVIEWED BY JESSICA KHAOU

Q: WHY DID YOU DECIDE TO PURSUE MEDICINE?

My older brother, who is 10 years older than me, was studying medicine when I started to think about my future career, and my father pushed the idea, so I didn't really have any other discussions or thoughts about alternatives. I went to medical school thinking I would cruise through it and become an exceptional brain surgeon (yes, really!) but then discovered the reality involved studying hard, regularly and with discipline that I had not accrued to that point.

Having been kicked out of medical school, I actually had to think about what other options there were and ended up studying languages with business.

As part of those studies I found myself living in Switzerland for 9 months where I met medical students and law students.

Having no family or friends or connections to the law, I turned my thoughts back to medicine as I felt it would be the most fulfilling as I had interests and skills in many areas and felt it would be best suited to me. I had tried other things like teaching, management, translation, administration etc during vacation periods. However, none felt like a long term prospect.

Medicine holds all the elements that pique my interest - sciences, discoveries, helping others, sociology, making a difference, transformations, the micro and macro meaning of life.

Q: WHAT DID YOU DECIDE TO SPECIALISE IN AND WHY?

I knew I wanted a family. I knew I wanted variety rather than focusing on one particular speciality. This left me with Accident and Emergency or General Practice. I naively thought GP would allow flexibility for raising a family. Therefore, I chose to be a GP.

Q: HAVE THERE BEEN ANY MEDICAL CASES THAT HAVE STUCK WITH YOU?

Too many! While I was on call/crash call during a hospital rotation, I was called to a patient and arrived to find someone performing very poor CPR on the man. I knew that the patient was never going to make it because the CPR was half-hearted and ineffectual. There was a lady with an unusual diagnosis, which meant we knew she was going to die by choking, and so the fear of not being able to help her die 'well'.

The lovely lovely man I went to visit on a weekend at home because he and his wife struck a chord with me, and to witness his final breath when I walked in just as the carers left. Not quite knowing how to deal with it as technically I was there as a friend and not as a professional. I was unsure who to call and had many questions in my mind: could I declare his time of death? Could I remove his syringe driver? As well as keeping the special relationship going with his wife, who also was and still is an ongoing patient for 12 years since his death.

The patient who specifically told me not to tell her her prognosis, who died very rapidly and whose family were in uproar about it because they did not know.

The privilege of keeping confidences of the old and the young and all inbetween.... It's an incredibly special thing which I feel honoured to do.

Q: HOW DO YOU MANAGE YOUR WORK LIFE BALANCE?

For the last 4-5 years (pre-pandemic because of in-house work politics and disruption, followed by the pandemic) there was no work-life balance. However, after the suicide of a colleague and another deciding to leave the NHS altogether, swiftly followed by the early death from cancer of a friend, I have taken action and positively stepped down from responsibilities and this year have cut my working hours to allow time to breathe, see my children and enjoy time doing simple things like exercise and sleeping a full night's sleep!

Q: WHAT ADVICE WOULD YOU GIVE TO ASPIRING MEDICS IN THE SCHOOL?

I think if you really know this is what you are wanting to do, and are going in with your eyes open and fully informed of what you stand to gain and lose - then you should absolutely do it.

Be prepared to miss weddings, birthdays and Christmases. Be prepared to be exhausted and still have life and death decisions to make. Be prepared to cry over injustice, over unfairness, over poverty, over political nonsense, over bullying, over racism, sexism and chauvinism - all of which are still ever present.

Be prepared also to hold new life, to help life pass well, to hold secrets, to help broken lives as well as broken minds and bodies, to live one of the most rewarding and fulfilling lives I can imagine. As well as to feel worthwhile, to feel you have made a difference in this world, to feel proud of your team when all goes well.

My advice is work hard, stay focused, ensure you keep the friends who will carry you through the difficult times close. Get a routine early and remember each day is a new day. Look forward, not back but still learn from your mistakes and try not to make any twice! (Once is a mistake, twice is carelessness, three times is stupidity!)

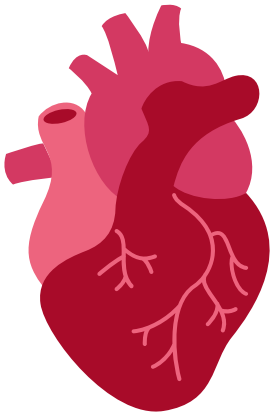
MEDICAL NEWS

WRITTEN BY YEAR 12 FRANCESCA URRY

Recent uses of stem cells to create Organoids in order to further the study of diseases affecting human organs.

There have been two recent cases: On April 4, 2023 a team at the Technical University of Munich managed to create an organoid heart and on June 1, 2023 a team at Rockefeller University created miniature lungs.

The Munich team managed to induce embryonic stem cells to emulate the development of the human heart. The aim was to study how our hearts form in the womb, which as it happens so early in pregnancy (it is fully formed by 3 weeks) we know little about, and to aid research into heart diseases and congenital heart defects.

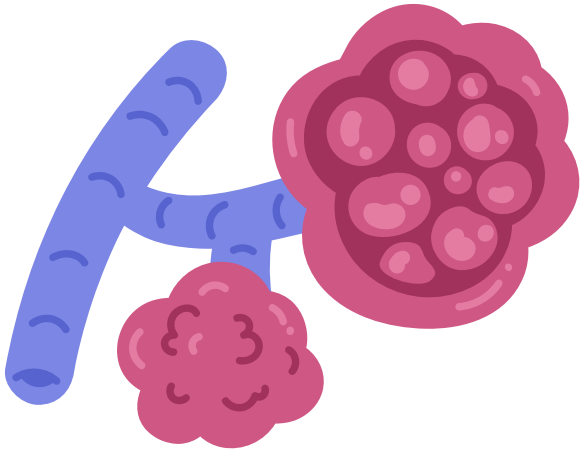


Each one was created using 35,000 pluripotent stem cells that were then spun in a centrifuge to form a sphere. Over several weeks signalling molecules were added to simulate the signalling pathways in the body that control heart development. These were the first ever organoids that contain both the cardiac muscle cells (cardiomyocytes) (which had been previously included) and the cells of the outer layer of the heart (epicardium) hence why these new hearts are called epicardioids. The epicardium was necessary to be a more accurate representation of the heart as some types of cells in the heart are formed from the epicardium, for example, the connective tissues.

The half a millimetre wide epicardoids are still a long way off a fully functioning heart but they can contract when stimulated with electricity. The team also discovered a precursor set of cells, whose function is to form the

epicardium, are created on the seventh day and remain for a mere few days, which they theorised could be the reason only foetal hearts can repair themselves.They were also able to create organoids from patients with specific conditions, for example, they took the pluripotent stem cells from a patient with Noonan disease and managed to create an organoid which reflected the disease. In the future drugs could be tested on these organoid hearts instead of animals or patients.

The Rockefeller team focused on using human embryonic stem cells to create lung buds (the embryonic form of lungs) to study the effects of Sars-Cov-2 in particular on the lungs.

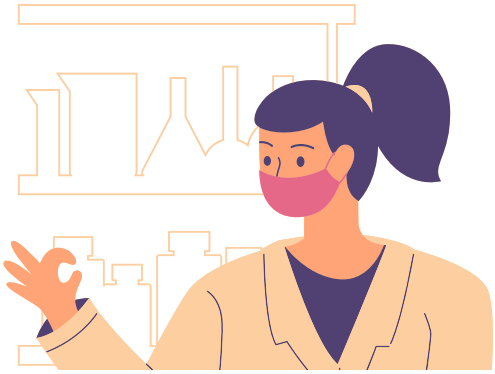


The stem cells are able to grow rapidly when placed in microchip wells (as they are a confined space) with signalling molecules from 4 different pathways added. Hence genetically identical lung tissue can be created, which means that in the study of virus progression, the genetic factor can be controlled and remain constant, meaning that purely the virus is studied. The lung buds have airways and alveoli, which were affected in coronavirus patients. The results showed that the alveoli were more susceptible to the virus. They also compared the lung buds to post-mortem lung tissue from covid patients and found that the BMP signalling pathway made the alveoli more susceptible. Furthermore, other diseases can be studied using the lung buds, such as influenza, other pulmonary diseases and lung cancer.

Organoid development is a growing area of significant research; other organoids that have been produced include pancreatic organoids, liver organoids as well as kidney organoids. While at present they are not sufficiently advanced and accurate there is the potential in the future for them to be used in transplants.

Q&A

WITH DR MARIA STELLA SASSO, PRINCIPAL SCIENTIST AT AKAMIS BIO
INTERVIEWED BY JESSICA KHAOU



Q: COULD YOU DESCRIBE A NORMAL WORKDAY FOR YOU?

I am a Principal Scientist in the Research Department at Akamis Bio.

My main job responsibilities are leading research projects, coordinating the work of more junior scientists, and providing technical support and scientific input in the context of various Research Team's activities.

Practically speaking, this means that I normally spend a big portion of my workdays designing experiments needed to answer to various project-related scientific questions, analysing or revising experimental data, reading scientific literature, talking to people with different roles in the company in order to get their opinion on various topics, and organizing and co-ordinating collaborative work.

An important part of my job is also supporting junior scientists in their work, which means training them on different laboratory techniques and methods, supervising their practical work and answering all sorts of questions about how to properly design/plan an experiment, how to interpret what they see as a result of these experiments, and how to solve problems and unexpected issues that arise during day-to-day laboratory work.

Q: WHAT IS THE MOST REWARDING PART OF YOUR JOB?

For me one of the most rewarding parts of my job, and of being a preclinical research scientist in general, is being able to interrogate the human biology, answer scientific questions and prove hypotheses through the use of various models, for instance being able to use cells obtained from a multicellular organism and grown in the lab.

Also, as scientist working in the oncology field, I am proud to play an active role in the fight against cancer and contribute to the development of new treatments that can give hope to cancer patients.

Q: WHAT ARE SOME CHALLENGES YOU FACE AS PART OF YOUR JOB?

The main challenge in my line of work is that research is inevitably a risky job, in the sense that sometimes scientific hypothesis are not correct and experimental results can be disappointing.

Work can be hard and frustrating, however, when after multiple trials and efforts you finally reach good results, that is highly rewarding and makes all the journey that led there worth it.

Q: CAN YOU TELL ME ABOUT YOUR RESEARCH?

Akamis' therapeutic approach focuses on the development of viral vectors (a vector is a vehicle used to transfer genetic material to a target cell) that specifically replicate only in tumour cells.

These vectors are genetically modified to produce, within the tumour tissue, different molecules that can help the immune system to recognize and destroy cancer cells, thus helping fight the disease.

Me, and the immunology team of which I am a part, specifically focus on studying how the immune system responds to our vectors, and how we can design improved vectors able to activate immune cells to fight tumours in the most efficient way.

Q: WHAT ADVICE WOULD YOU GIVE TO AN ASPIRING MEDICAL RESEARCH SCIENTIST?

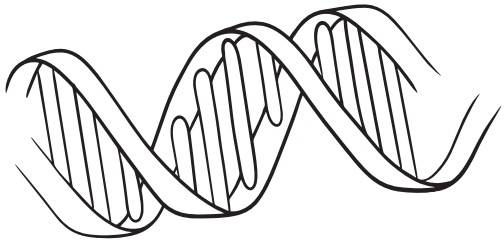
My main advice is to try to understand which biomedical research field mostly sparks your interest, intellectual curiosity and motivates you (this may be cancer, immunology, neurology, bioengineering, or anything else... the possibilities are many!), and then be determined to pursue a career in that field. I believe that when your job is also a passion, everything becomes easier and more motivating.

IS GENE THERAPY ETHICAL?

WRITTEN BY YEAR 12 STUDENT ANNA MCCRANN

The term ‘gene therapy’ can be described as modifying the expression of a gene or altering the biological properties of living cells to treat a disease. There are a variety of different gene therapy products which can be used; these include plasmid DNA which carry therapeutic genes which can be entered into human cells. In addition, viruses can be modified to remove their ability to cause infectious disease and instead are used as vectors to carry therapeutic genes into human cells.

However, these procedures could be considered unethical because not everyone considers a normal trait to be a disability which needs to be genetically modified and vice versa. Furthermore, does the high cost of gene therapy make it available only to the wealthy and discriminate against others who may not be able to afford it?

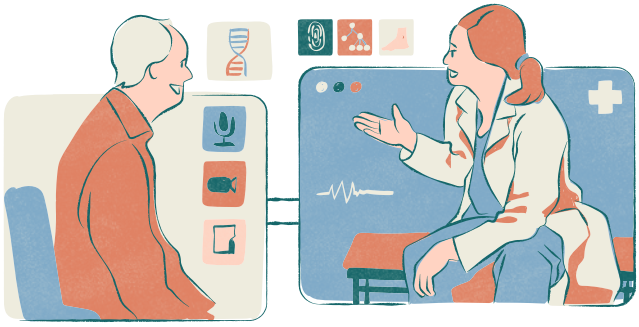


Another type of gene therapy which I will be discussing is germline genome editing (GGE); this is still being developed and consists of targeting therapy to egg and sperm cells (germ cells), which would allow genetic changes to be passed onto future generations. This is controversial because eventually gene therapy could be used to enhance basic human traits, as well as curing genetic diseases and disorders.

Germline therapy could affect not only the development of the foetus but also when it develops into an adult, the adult could pass on the edited genes to children of their own. This causes huge ethical issues as the unborn child is already born with the edited gene, without having had an input on the decision. Certain scientists and researchers, including UNESCO (United Nations Educational Scientific and Cultural Organization) have called for an international ban on research for gene editing human embryos, which shows how unethical it is considered currently to be to carry out this treatment.

However in 2015, many different medical academies from around the world rejected the calls for this ban because the potential for this therapy to prevent disease is seen as more of a benefit, which outweighs the risks. They did call for a ban on the clinical use of GGE, and recommended this should be revisited every few years.

Another example of when this therapy can be useful is when sperm cells are modified through spermatogonial stem cell (SSC) editing. This is the process of retrieving sperm cells and transfecting them with programmable nucleases, which allows the edited SSCs to produce mutation free sperm cells. After this, IVF can be used to help with reproductive success and prevent offspring having certain diseases. In my opinion GGE has huge potential and could be used to successfully prevent life threatening diseases and infertility, which could change the lives of many.



Q&A

WITH DR JOE WILSON, FOUNDATION 1ST YEAR JUNIOR DOCTOR AND GRADUATE OF ORIEL COLLEGE, OXFORD UNIVERSITY
INTERVIEWED BY Y11 STUDENT EVIE CHALK

Q: COULD YOU EXPLAIN WHAT IS GOING ON WITH THE STRIKES? WHY ARE THEY HAPPENING?

The incentive for the strike is that the cost of living for everyone has gone up massively - the inflation rate has been at 10% for a year. Doctors haven't seen their pay go up, in material terms, since 2008.

If I look at my payslip as an F1, compared to someone who had their payslip back in 2003, we take home the same amount of money at the end of the month, yet the cost of buying stuff is so much more than it was back in 2003.

The other thing is that we don't have enough doctors in the country, a lot of people are looking to leave their work and go into other healthcare systems like Australia, or to work privately.

Part of that is because the working conditions aren't very good and the pay isn't as good as it should be. I think that correcting that by paying people more would discourage people from leaving. I think it could plug that gap and make the health service better overall.

Q: WHAT ARE YOU HOPING TO ACHIEVE WITH THE STRIKES?

What we want to demonstrate is that we're serious. We know that starting on £30,000 a year is a very nice amount of money compared to most, it's more than the average wage in this country for certain. But our performance as a healthcare system is dwindling. A lot of that is because we don't have enough doctors, or nurses.

By striking around the same window of time as nurses, physios, paramedics, we're all collective in hoping to demonstrate that there's something wrong in the system. Patients are suffering because of it, and we're not going to stand by and let that happen.

Q: WHAT KIND OF CHANGES NEED TO BE MADE?

The BMA's mandate is calling for complete pay restorations. The pay has been reduced by 26% since 2008 and if you reverse the maths on that, you would need to increase pay by 35% to reverse this.

Personally, I'm looking for an increase in pay that offsets the amount of increase in the cost of living. The inflation rate of food is at about 20% which is ridiculous. I would like to see less people leaving and I would like to see our quality of care improve.

Q: WHAT DO YOU THINK THE STRIKES MEAN FOR PATIENTS AND OTHER COLLEGES?

Broadly I've been surprised by the amount of support we have from patients. I think they understand that we do things in their best interest. Sadly yes, we've had hundreds and thousands of appointments canceled during the strikes. But emergency care has continued, and consultants have covered for us very well. There's good evidence to suggest that there has not been an increase in mortality when doctors strike.

The consultants have been very supportive, particularly the consultants who were in our position 15 years ago.

They say that actually the job has changed and your pay has stagnated. They think it's ridiculous that we take home the same amount of money as they did 15 or 20 years ago.

Q: WHEN YOU WERE YOUNGER IS THIS WHAT YOU EXPECTED ABOUT BEING A JUNIOR DOCTOR?

No it's not even close. I remember being told when I was maybe 16 that medicine isn't a glamorous career. In the old days like the 20th century doctors were in white coats and they were revered. Everyone just implicitly trusted and celebrated them. And that's not exactly what I wanted but as a healthcare system we have become worse, we don't offer as much as we used to.

I think the public's perception of doctors has changed. The amount of abuse I get yelled at me on the ward by patients and their relatives, the names I get called, stuff being thrown at me on occasions. It's stuff like that I was not expecting.

Q: WHAT FIRST INSPIRED YOU TO PURSUE MEDICINE?

For me it's always been about the science and being able to apply that science in different ways. There are different people and everyone has their own individual context. Let's say someone has a kidney stone, you don't treat everyone with a kidney stone the exact same way because you have to take into account everything that's going on with that patient, not just medically but also their own wishes. So I like being able to tailor what I know about science and apply it on an individual basis.

Q: WOULD YOU NOW RECOMMEND A CAREER IN MEDICINE TO A YOUNGER PERSON?

It's really tricky, I think if it continues on this current trajectory, it might be a no. But if things can be reversed, then yes. When the job is good it's great and I wouldn't change it, but there are some things that just grind you down and you just think: what are we doing this for?

Q: WHAT ADVICE WOULD YOU GIVE TO A YOUNGER PERSON INTERESTED IN MEDICINE?

Try and get as much work experience as you can, which I know is tricky, but do different types of settings - GPs and hospitals. If you want to do medicine you're probably going to enjoy your science and working with people. But being a doctor isn't the only career that marries those two together so you should also explore other career areas.

I think medicine is one of those things that as soon as someone starts getting good grades at school, people start saying: "Have you thought about being a doctor? Have you thought about being a lawyer?" There are lots of exciting careers out there that have the application of science for people other than medicine.

THE JUNIOR DOCTOR STRIKES

WRITTEN BY YEAR 11 STUDENT EVIE CHALK

Junior doctors have undertaken a series of strikes in response to pay cuts and mistreatment. The first strike lasted from May 13th to May 15th 2023 (a period of 72 hours) and the second strike from April 11th to April 14th 2023 (96 hours). On these dates, over 50,000 junior doctors walked out in protest. Strikers marched through Trafalgar Square and to Downing Street, bearing signs and chants of their demands.

Junior doctor pay has decreased by 26% since 2008, when inflation is taken into account. With the cost of living crisis, the cummulative inflation rate is at 102.2% since 2003. Junior doctors suffer from this on top of five years worth of medical school debt, and both professional membership and examination fees.

The British Medical Association calls for full pay restoration to reverse the steep decline in pay since 2008, with the demand of a 35% pay increase. The government is refusing to negotiate with the BMA on these terms, deeming their demand "unreasonable in the current economic context".

The lower wages have made it more difficult to recruit and retain junior doctors. Healthcare workers have left the NHS to move into other healthcare systems or into private practice. Junior doctors could double their salaries by working in management consulting, or earn up to a 50% higher salary by moving to the Australian or New Zealand healthcare systems. Without as many professionals, the NHS has been put under more stress to deliver its high standard of care.

While their pay is dissatisfactory, junior doctors also express disappointment in their working conditions. There has been a breakdown of relationships between junior doctors and individual wards, there is a loss of facilities and a sense of belonging for them. Junior doctors are at the front line when explaining the failings of the NHS to patients and their families, as well as working extra unpaid hours to cover shortages. Members of the BMA explain that they feel ‘overworked and undervalued’.

It is acknowledged that doctors are paid substantially more than average wages, which is why their demands are being ridiculed. However it is important to consider that junior doctors work tremendously hard and excruciating hours with decades of training. The government considers that other members of the healthcare system are in more challenging positions, such as nurses. Allegedly, ‘if there was some money to give a pay rise to NHS staff, doctors would not be at the front of the queue.’

196,000 hospital appointments, including 20,000 operations, were cancelled as of April 18th 2023 due to the strikes. Junior doctors explain that they have no other option than to turn to such measures. With decreased pay, junior doctors are being forced to consider their options, with the excodus from the NHS leaving the hospitals understaffed and consequently compromising patient care.

Q&A

WITH THIVYA, VETERINARY MEDICINE STUDENT AT THE UNIVERSITY OF SURREY. INTERVIEWED BY FRANCESCA URRY

Q: WHY DID YOU CHOOSE VET MED?

I always knew I wanted to study something medicine or science related and for me it was a toss-up between doing either paediatrics or being a vet and I know it sounds cliche, but I really love animals and that's what decided it for me.

Q: HOW WOULD YOU DESCRIBE THE COURSE AND THE ASSESSMENTS?

I started university during Covid times, so my experience is probably very different to the reality! Even though we did our lectures from home, there were still plenty of anatomy practicals and animal handling practicals in the 1st and 2nd year which helped our learning alongside the lecture content.

Now, we more or less have 3-4 hours of lectures every day during the week as well as group work activities or practical sessions some afternoons. The clinical practice only begins in third year, but you get plenty of opportunity to practise in our clinical skills area, which is open all day in the week.

We have two exam periods at Surrey, one after each semester in January and June. These are made up of MCQs and SAQs as well as some picture-based questions. Though it may sound daunting at the moment, we get plenty of practice questions beforehand, so you'll know what to expect! There are also other group work projects and lab reports which contribute towards your final grade.

Q: WHAT HAVE YOU ENJOYED MOST ABOUT THE COURSE SO FAR?

I have definitely enjoyed the third year most because it allows us to apply and put together all of our anatomy and pathology knowledge from first and second year and we learn how to recognise diseases in a clinical setting. Of course, all the animal handling practicals during 1st and 2nd year are great too!

Q: WHAT UNIVERSITIES DID YOU APPLY TO?

I didn't get in the first year I applied but I applied to Bristol, Nottingham, Cambridge, and Edinburgh. I got an interview at Cambridge but unfortunately, I didn't get any offers.

The second time around I applied to RVC, Surrey, Nottingham, and Bristol. This time I got interviews at Nottingham, Surrey, and RVC. I got an offer from Surrey and that's where I am now.

Surrey is a very modern university with practical based learning from day one which I really liked. It is also close to home (South Oxfordshire) making it very convenient too!

Q: WHAT WORK EXPERIENCE DID YOU DO BEFORE APPLYING TO VETERINARY SCHOOL?

I spent 1 week at 3 different veterinary practices as well as doing some more animal handling-based placements at a kennels, donkey sanctuary, and a dairy farm.

Though most universities have a required number of placements, it is not just about how much you have done. They are more interested in knowing what you have learnt from the experience. For example, whilst I was at the kennels, there was a dog who had suffered from a stroke so I used this to learn more about strokes in dogs and what would have caused it for example.

When getting work experience, I would really recommend trying something new and work with animals that you may not be as familiar with to really improve your confidence with them.

Work experience can be very hard to find, especially after Covid so don't worry if you haven't gone above and beyond the requirements. You will have plenty of opportunities during your course and EMS placements during university to develop your animal handling skills!

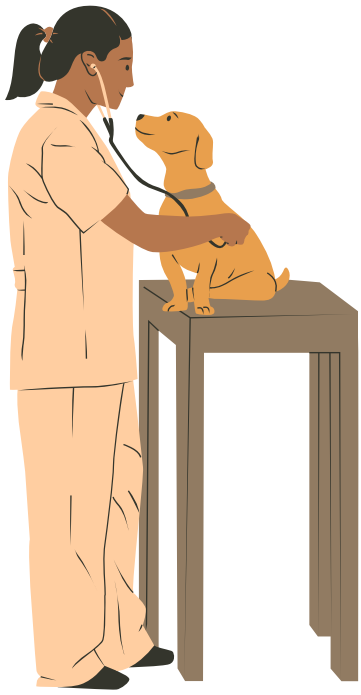
Q: HOW DID YOU FIND THE APPLICATION PROCESS AND IS THERE ANYTHING YOU WOULD HAVE DONE DIFFERENTLY REGARDING YOUR PREPARATION?

I found the application process fairly straight forward both times around. The one thing I would have changed is how I prepared for my interviews. Some universities had MMI whereas others had a more

sit-down conversation approach. Even though you're never going to know what kind of questions you will be asked, familiarising yourself with the interview style will definitely help you.

My school offered practice interview sessions and MMI advice so attending something similar would be very useful, or even just reading about it online and knowing what to expect is good preparation.

Regarding your personal statement, don't worry about fitting everything in if there is more you want to say. Most universities usually send out another questionnaire for you to fill out which gives you a chance to expand more. The interview is also another great opportunity to talk about things not mentioned in your personal statement.



Q: WHAT IS YOUR WORK-LIFE BALANCE LIKE? DO YOU HAVE TIME FOR A SIDE JOB AND/OR EXTRACURRICULARS?

It is definitely possible (and encouraged!) to have a job or be part of a society outside of the course. I have a weekend job at a shop, and many of my friends are part of multiple different societies. Though it can be more difficult at times than others, I enjoy having some time away from the course to focus on something different. The key is to be organised with your time management and making sure you have a good balance between university work and your life outside.

Q: WHAT ARE YOUR CAREER ASPIRATIONS AND PROSPECTS AND HOW MUCH DOES THE UNIVERSITY HELP WITH THIS?

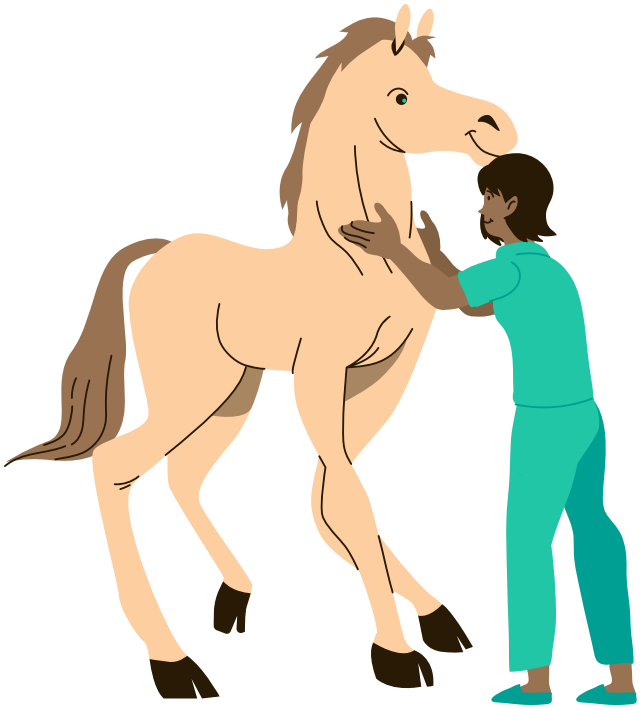
I want to go into farm animal work, but a lot of my friends have other niche career aspirations. Though the university doesn't specifically address career prospects, they do host many careers fair events, which gives us the opportunity to talk to vets from different fields about their careers.

Regardless of which university you go to, you will have to do a certain number of weeks of EMS placement outside of term-time, and these are a really good opportunity to find and choose something that you are particularly interested in.

At Surrey, there are a number of different societies for different fields such as farm, pathology, zoo... (the list is endless!) so there is definitely something for everyone and these societies are great for finding the particular resources and people you'll need to help develop your future career.

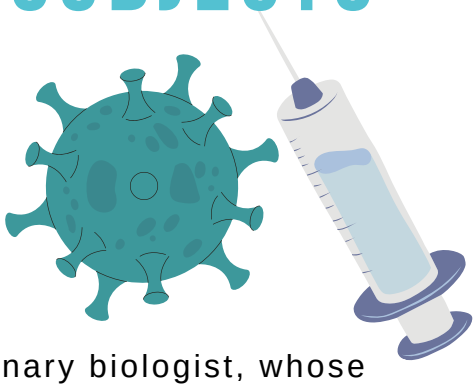
Q: IS THERE ANY FURTHER ADVICE YOU WOULD GIVE ASPIRING VETS?

The most important thing is don't give up! I didn't get in the first year I applied so decided to take a gap year and I spent this time doing more work experience and volunteering to build up my skills working with animals. There are lots of people at different stages of life in my year, there are people fresh out of school, people who have taken gap years, and people who have already done other degrees! You will never be judged if you don't get in the first time round because there are so many people who will be in the same boat as you. Don't be afraid to try again!



WIDER READING AROUND SUBJECTS -LYNN MARGULIS

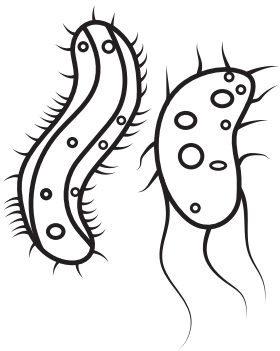
WRITTEN BY Y12 STUDENT ANJALI RAMESHWARAN



Lynn Margulis (1938 - 2011) was an American evolutionary biologist, whose research revolutionised our understanding of the history of life through her endosymbiotic theory, and collaboration with the British chemist James Lovelock on the Gaia hypothesis. She was also a staunch supporter of Robert Whittaker's five kingdom classification.

Margulis adopted a Darwinian (survival of the fittest) approach to her biology. Her work focused on symbiosis - the interactions between two different organisms living in close physical association, typically to the advantage of both. Early on in her career, Margulis' work was not accepted, as it was deemed too radical, with one of her most important papers called "On the origin of Mitosing Cells" (which hypothesised that 3 organelles - mitochondria, plastids and flagella - were once free prokaryotic cells) being rejected by 15 journals before being published in 1967.

Leading on from that 1967 paper, Margulis published another paper in 1970 called "Origin of Eukaryotic Cells", where she expanded on her initial hypothesis. In these papers Margulis further championed the endosymbiotic theory - a theory about the origins of life. The endosymbiotic theory postulates that the organelles within eukaryotic cells, like mitochondria, chloroplasts, etc. were once separate prokaryotic microbes, and an ancient Archaean engulfed these prokaryotic microbes forming organelles. There is in fact evidence for this.



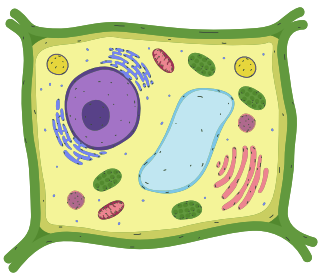
For example, mitochondria is:

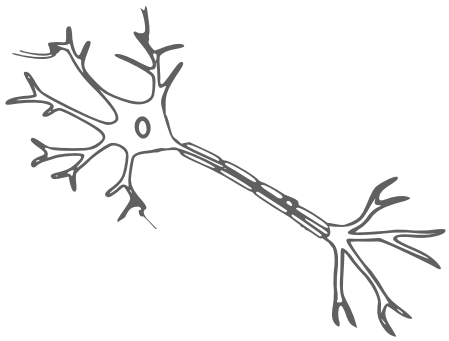
- The same size as prokaryotic cells
- Divides by binary fission
- Has its own DNA (which is circular not linear)
- Has its own ribosomes

The endosymbiotic theory - although voiced earlier on by Russian botanist Konstantin Mereschkowski - was actually only accepted in 1967, when Margulis presented strong genetic evidence that supported her theory. Consequently she was awarded the National Medal of Science in 1999, was elected a member of the National Academy of Sciences in 1983 and was awarded the Darwin-Wallace medal in 2008.

Margulis also worked on the Gaia hypothesis with James Lovelock. The Gaia theory proposes that all organisms and their surroundings on Earth are closely integrated to form a single, self-regulating complex system, maintaining the conditions for life on the planet. Simply put it suggests that organisms co-evolve with their surroundings and as physical changes on Earth occur, living systems respond to mitigate such changes. However this theory from Lovelock and Margulis has not been widely accepted, with many other scientists making compelling arguments against it. For example, the theory has not fully factored in evolution by natural selection, and competition between organisms. There is also nothing in the genome of individual organisms that would provide the response that Lovelock and Margulis present.

Lynn Margulis has persevered through a lot of criticism from the scientific community to voice what she believes in. Her promotion of the endosymbiotic theory was revolutionary for biology, and is still the most widely accepted theory about the origins of life as we currently kno.





Q&A

WITH JAYNE DURBIN, PAEDIATRIC PHYSIOTHERAPIST INTERVIEWED BY AHYOUNG KIM

Q: COULD YOU DESCRIBE YOUR TYPICAL WORKDAY AS A PAEDIATRIC PHYSIOTHERAPIST?

There is no such thing as a typical day at my job. I have worked as one of the NHS AfC Band 7 roles for the past 26 years (NHS AfC stands for Agenda for Change, which is a pay system for all NHS employees apart from the doctor. It is divided into 9 bands, with 1 having the lowest pay rates and 9 having the highest pay rates), at the Nuffield Orthopaedic Centre, treating patients with clubfoot (when a baby is born with a foot that turns inwards and downwards), DDH (Developmental dysplasia of the hip where one of the joints of the baby's hip does not properly form), MSK (musculoskeletal) problems, as well as scoliosis (condition where the spine twists and curves to the side, which commonly starts in young children) using physical therapies. In addition, I work in paediatric orthopaedic clinics where I see a variety of post-surgery patients.

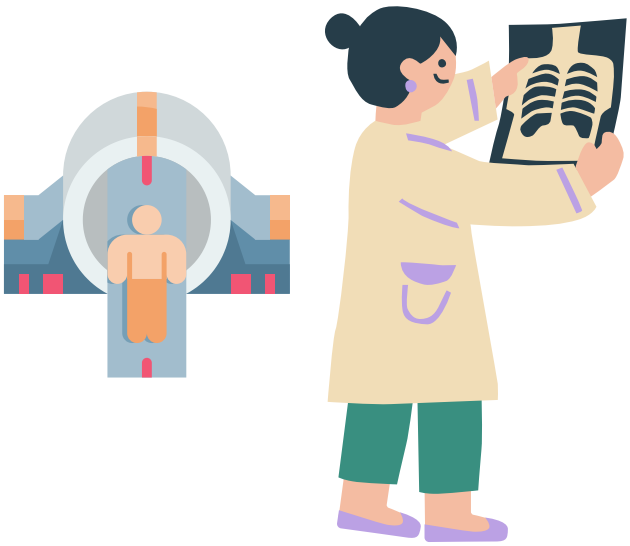
With this type of work, we would use both our normal physiotherapy skills set and casting techniques we have developed over time on the job. This involved casting babies and toddlers with CTEV (Congenital Talipes Equino Varus, when a newborn baby's foot is rotated inwards and downwards), using POP (plaster of Paris, used to make plaster casts in medicine to stop broken bones from moving whilst the patient is recovering), post-surgery physiotherapies requiring new casts, or serial casting for tip-toe walkers.

Although I could have a full list of patients for the day, emergencies would come in. In other words, a consultant might ask you to see a patient from one of their clinics, or a parent might need to call in because their child has a cast slip, which would need to be seen that very day.

Additionally, I run my own independent hip screening clinic once a week and am involved in teaching junior staff members, registrars, and others.

My day varies greatly now that I work as an ACP (Advanced Clinical Practice) at Milton Keynes Hospital. My role is to run the CTEV and DDH hip screening service, which means that I am responsible for triaging referrals, making sure the service follows NIPE (newborn and infant physical examination) guidelines, and ensuring that patients are seen within the appropriate time frame. These jobs involve collating data, engaging in auditing, teaching, and service development.

As I have already mentioned, I run my own clinics where I see patients with MSK issues as well as normal variants. Here, I order x-rays and MRI scans and request blood samples if needed.



These clinics are booked on certain days, and I have admin days, yet I often get called to see patients who are having problems, for example, parents who have called because their child or baby has a cast or Pavlik harness (a soft brace used to treat dysplastic hips) issue.

Within my days, I also have meetings scheduled with other health professionals to discuss running and improving the service, as well as teaching sessions with B7 staff.

Q. WHAT MADE YOU WANT TO BECOME A PAEDIATRIC PHYSIOTHERAPIST?

When I qualified 30 years ago, you were required to work as a basic grade (B5) and complete your basic grade rotations for approximately 3 years before seeking a higher grade job. During my rotations, I loved working on the adult trauma, orthopaedic, and paediatric wards. When I was ready to move up to a higher-grade job, it so happened that the Nuffield was advertising a paediatric orthopaedic position, which was essentially the combination of my two favourite rotations! Having learnt the casting and bracing skills on the job, I have become an expert in them over the years.

Working with children is so rewarding and varied. If you are treating kids with clubfoot over the course of many years, you get to know both the children and their parents very well. These kids, more often than not, look forward to coming to see you at the hospital and will greet you so happily that it is the best part of the job!

Working with teenagers can be difficult at times; while some are chatty and you can learn a lot about the person from themselves, others can be moody and occasionally unresponsive, so that you have put in a lot of effort to win them around. However, if I get a smile from those children, I feel as though I have really accomplished something.

Q: WHAT DO YOU FIND REWARDING ABOUT YOUR JOB?

Treating clubfoot has always been one of my favourite things. You begin the process with a foot that points downward and inward with bones in the foot that are misaligned on top of tight ligaments, tendons, and muscles. Following this, you work to gradually manipulate and cast the foot to correct it. The parents are always so grateful to see how much their child improves every day, which is rewarding.

Also, I often see babies with severely dysplastic hips or dislocated hips and work to realign and centre them. This means that going forward, they should have no further problems.

Above everything, the best part of my job is seeing any children who come to me with pain and discomfort be discharged happy and pain-free. This makes me feel content and gives me a sense of accomplishment that I did a good job.

Q: ARE THERE ANY CHALLENGES YOU FACE?

These days, the challenges are more related to funding or inadequate staffing.

Lack of funding frequently has a direct impact on patient care as it makes it more difficult to secure all the equipment that is needed, or to provide aids for patients. In terms of staffing, it is inadequate mainly due to the posts that have been cut or due to the difficulties in recruiting people for the positions.

Other challenges include a degree of administration, the need for unnecessary paperwork, and a lack of resources and space.

Q. WHAT SKILLS DO YOU THINK ARE IMPORTANT FOR ONE TO BECOME A SUCCESSFUL PHYSIOTHERAPIST?

The first thing to emphasise is listening, as it is a key to successful therapy sessions.

In addition to this, empathy and a sense of humour are very helpful when communicating with patients and their guardians. Similarly, having excellent interpersonal skills from the beginning is important, although these do improve with time.

You should constantly think outside the box and be prepared to face challenges head-on because they could arise suddenly or unexpectedly.

On top of this, I would say that it is crucial for you to be willing to work hard, learn new ideas, adapt to the new environments and collaborate as a team player, especially when you will be working in a setting where communication is highly important.

MARIE CURIE'S CONTRIBUTION TO SCIENCE AND MEDICINE

WRITTEN BY Y12 STUDENT AHYOUNG KIM

Marie Curie (1867-1934) is a well-known scientist for her work in discovering radium and polonium, which became the fundamentals of modern nuclear medicine. Curie's other accomplishment was developing radiological cars during World War I.

Marie Curie was born in Warsaw, the Capital City of Poland in 1867. Before enrolling at the Sorbonne University in Paris to study mathematics and physics, she worked as a tutor and governess while continuing with her education. A few years later, she met and married Pierre Curie, who was a scientist working in Paris.

Marie and Pierre Curie then began working at the School of Chemistry and Physics. They started researching the unknown rays emitted by uranium, which was a phenomenon that Henri Becquerel had previously noticed.

What Curie soon realised was that pitchblende, an ore of uranium, was significantly more radioactive than uranium was believed to be. The Curies therefore put forward the hypothesis that a new element existed and that it must be very radioactive. Through a variety of experiments and investigations, they were able to collect a small sample of this new element, which was later named polonium. However, pitchblende ore was still highly radioactive even after the polonium had been removed, and this led the Curies to discover another element called radium, which was even more radioactive than polonium.

Marie Curie was also a developer of "petites Curies" (radiological cars), which are vehicles fitted with X-ray equipment. X-rays are used in medicine to create black-and-white images of the internal body structure, based on the fact that different body parts absorb x-rays to different extents.

For instance, the heart would appear darker in the image while bone appears white because the heart is easier for x-rays to pass through than bone. Petites Curies were especially helpful during World War I (1914-1918): at that time, X-ray machines were only available from hospitals in large cities that were distanced from the warfront where the soldiers were stationed; a reason for this could have been because X-rays were only discovered in 1895. The car allowed the doctors to scan the body of the injured soldier on the battlefield so that they could clearly see the wounded area and perform better, more targeted surgery. Curie also helped to further modify the vehicle to reduce accidents and malfunctions, as well as educate “x-ray operators” herself by teaching knowledge in physics and anatomy.

This process involved a lot of struggle; pitchblende was an expensive ore at that time, and she needed a lot of it for the extraction of elements. In addition, because the radioactivity of these elements was unknown at the time and no protection equipment was often used, Curie became physically ill during this process. Marie Curie later passed away in 1934 from aplastic anaemia, which is thought to have been caused by her constant exposure to radiation. Aplastic anaemia is a condition where the bone marrow cannot make enough red blood cells.

Marie Curie won two Nobel prizes in total: the first was a joint award with Pierre Curie and Henri Becquerel in 1903 for their work in “radiation phenomena”, and the second one for her extraction of radium in 1911.

Curie’s discovery of the “natural radioactivity” of elements served as the foundation for many innovative treatments and diagnostic methods. One use is radiotherapy, which is frequently used to treat cancer and involves using a radiation beam to kill targeted tumours. According to the government, 10% of all cancer cases in the UK between 2013 and 2016 were treated with radiotherapy alone. This indicates that radiotherapy is one of the most commonly used forms of treatment, demonstrating the importance of Curie’s work, which has saved many lives. Another example is for imaging organs and other internal structures to learn more about their function. This is done by injecting radioactive isotopes with short half-lives into blood vessels. The radiation (gamma rays) can be detected outside the body and tell us information such as where the bleeding started or whether there is a blockage in the coronary arteries of the heart.

Marie Curie was the first woman to win a Nobel Prize. Her discovery of polonium and radium was the starting point for the development of modern therapeutic techniques, which have saved numerous lives across the world.

Q&A

WITH PROFESSOR NIRMALAN, PROFESSOR OF MEDICAL EDUCATION AND CONSULTANT IN CRITICAL CARE MEDICINE AT MANCHESTER ROYAL INFIRMARY, INTERVIEWED BY ANJALI RAMESHWARAN

Q. COULD YOU DESCRIBE A NORMAL WORKDAY FOR YOU? WHAT IS YOUR BALANCE BETWEEN ACADEMIC AND CLINICAL MEDICINE?

My day to day life varies, as about half the time I work in the hospital, whilst the rest of the time I work in the University. My hospital work is centred around the incredibly busy intensive care unit, where the patients are very sick. On the other hand, my work at the university is focused around teaching some of the most talented students in our country, helping them to become the next generation of doctors. Most of my research days are concentrated on the work we do in poorer countries in Africa and Asia.

Q. WHAT LED YOU TO WANT TO SPECIALISE IN ANAESTHESIA AND INTENSIVE CARE MEDICINE?

I have a keen interest in physiology, in particular the physiology of pain. I was drawn to anaesthesia as it is a very scientific discipline, with a foundation based on the core principles of physiology.

Also, the results of what we do are immediately visible, which I personally find very satisfactory. In addition to this, the department works with, and at times modifies some of the basic aspects of life such as consciousness, breathing, circulation and more, which is philosophically and technically very challenging yet attractive.

Q. WHAT MEDICAL RESEARCH OPPORTUNITIES ARE AVAILABLE ON CAMPUS?

Manchester is a leading university in the World. For example, in 2023, in the Times Higher League table of World Universities in terms of Global Impact (as articulated through the UN's SDGs) we were ranked 1st in Europe and 2nd in the World. We are the only UK university to be within the top 10 for 5 consecutive years since the launch of this league table. The recent investment by the National Institute for Clinical Research (NIHR) of over £60 Million to establish a comprehensive biomedical research centre has made Manchester an exciting place to live and undertake a wide range of research across multiple disciplines.

Our research beacons specialise on new materials, global inequalities, cancer and many other areas of great interest in the field of discovery sciences as well as applied sciences.

Q. CAN YOU TELL ME ABOUT YOUR WORK ABROAD? (KENYA AND SRI LANKA?)

I have been working on multiple areas in these countries. Post-conflict issues, including physical, environmental, cultural and medical issues in particular are of great interest to me. For example, we were the group that first applied Geographical Information Sciences (GIS) to aid research methodology within epidemiological studies in countries such as Uganda and Kenya. In Sri Lanka, I am currently collaborating with some frontline civic organisations and the University of Jaffna to look at the impact of rising sea levels and the consequent changes in the composition of groundwater, and what impact these changes have on human health.

Q. HOW DID YOU COME UPON OPPORTUNITIES TO DO WORK ABROAD, AND ARE THERE SIMILAR OPPORTUNITIES FOR STUDENTS?

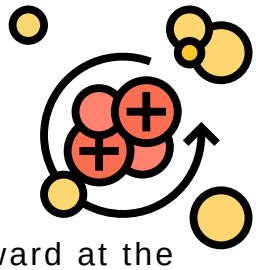
Most of the opportunities I have come across in my professional career have been through being sensitive to the needs of a wider population and being willing to work across professional boundaries. By noticing areas in people's lives that need improvement, you can undertake appropriate research, collaboration or work to help make it better. The experience of looking at the plight of all people living in Sri Lanka at the end of the protracted war in 2009 made me adopt a particular interest in the needs of other people living under such trying circumstances. The research opportunities follow these interests – some are serendipitous connections and others are through positive engagements following one's interests.

Q. WHAT ADVICE WOULD YOU GIVE TO SOMEONE WHO IS LOOKING TO STUDY MEDICINE?

Medicine is a vocation, not simply a job to do for more money or social prestige. One needs to be committed and be willing to make major sacrifices. Do not choose medicine as a career simply because someone – parents included - want you to become a doctor. If you are motivated by financial and other social considerations please do not choose medicine. If you are a person who derives joy by caring for the needs of others or you are a person who is fascinated by the brilliance of the human mind, body and its functions you will enjoy a career in medicine.....not otherwise.

WHAT IS PROTON BEAM THERAPY?

WRITTEN BY YEAR 12 STUDENT ANNA MCCRANN



Following on from my work experience in a children's cancer ward at the John Radcliffe Hospital in Oxford I wanted to find out about different treatments available for cancer. Proton beam therapy is a new treatment and is a form of radiation therapy that uses protons rather than x-rays (photons). It appears to have a promising future, but its benefits over using normal radiation therapy is still being researched. In general it can be said that this type of radiation therapy has less side effects than normal radiation therapy as it can be targeted more directly at the tumour and does less damage to the surrounding tissue, for example, if a tumour is close to the spinal cord then there is less risk of causing severe damage.

Currently, this type of therapy has treated over 170,000 patients globally, of which 75,000 were in America. This is hugely promising as each year more patients can be successfully treated. However, the equipment to carry out proton beam therapy is expensive and only available at two cancer centres - Manchester and University College London Hospital (UCLH). In addition, proton beam therapy is only suitable for certain types of cancers, such as complex brain, head and neck cancers, because for many other cancers high energy x-rays currently deliver the most effective treatment for patients.

However, the main problem with evaluating proton beam therapy is the limited amount of clinical studies available and consequently, health bodies such as the NHS are reluctant to invest in new treatment centres that rely solely on proton beam therapy.

This therapy would be ideal to treat prostate cancer because with normal radiation therapy the dose has to be decreased as it can be toxic, but with proton beam therapy the dose can be increased without exceeding the tolerance of the surrounding tissue. If proton beam therapy leads to a higher life expectancy after treatment, I think it has huge potential and could have positive results for millions of patients around the world. However, currently it is a more expensive way of treating cancer compared to radiotherapy.

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