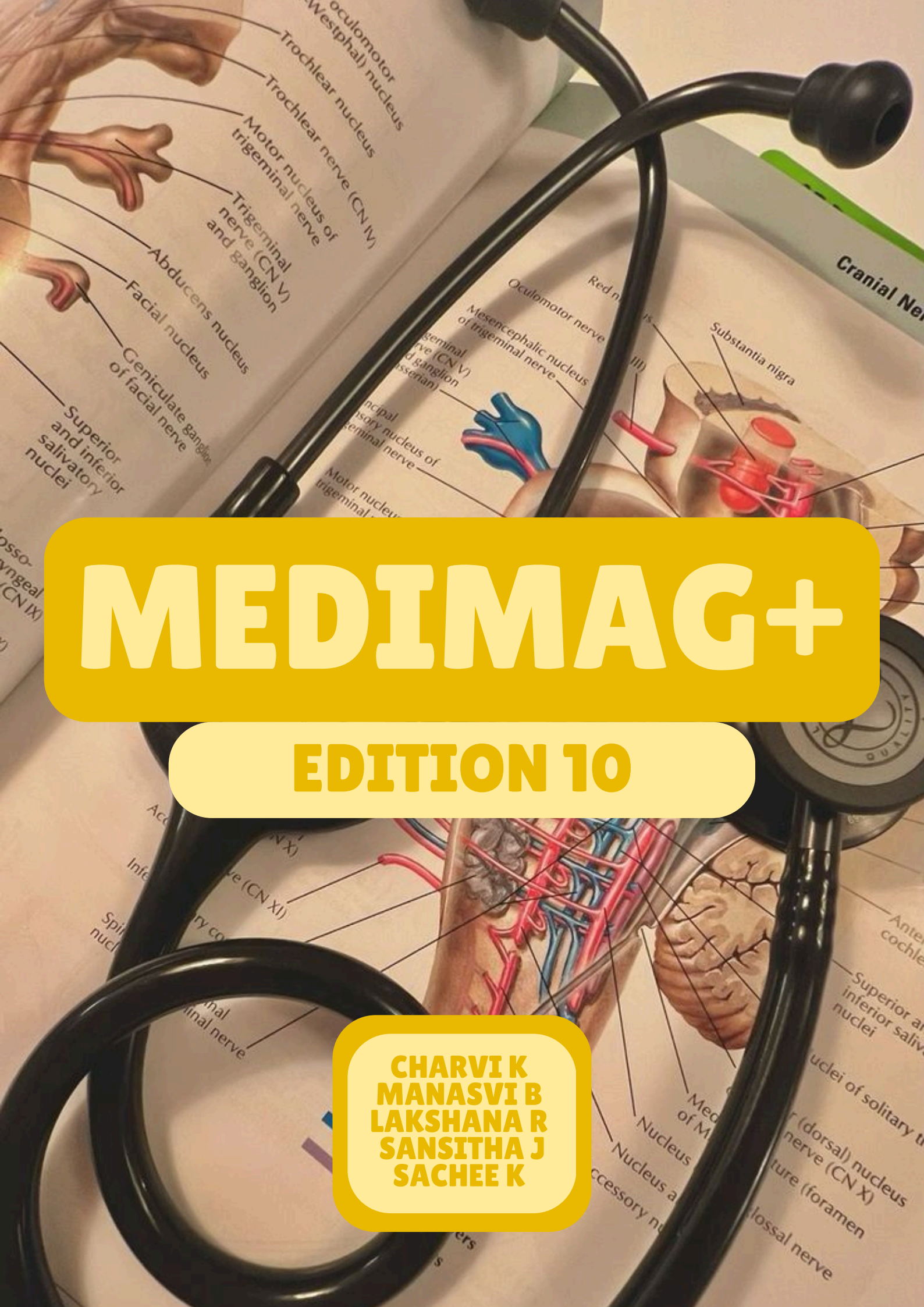


MEDIMAG+

EDITION 10

CHARVI K
MANASVI B
LAKSHANA R
SANSITHA J
SACHEE K

contents

CONTINUE OVER

contents

Genetic, Surgical & Technological Innovations

Synthetic Bone Graft Development

What are bone grafts?

Bone grafting is a surgical procedure where a transplanted substance (bone or synthetic material) is applied to the gaps in broken, deficient diseased, or damaged bones for additional support and to stimulate bone tissue growth in order to restore the desired strength of the bone. A bone graft can be used to repair almost any bone in the body. Donor bone is generally taken by surgeons from the hips, legs or ribs of the patient; in other cases the bone can be donated from cadavers. John Hopkins Medicine stated that an individual's skeleton consists of bone matrix, which is the hard material that helps give bones their strength. Inside the matrix are living bone cells, which are responsible for the production and maintenance of this matrix. The cells within this matrix can help repair and heal bones whenever required. These bone cells are often able to repair the bone themselves after a break, however in some cases a bone graft is required. A bone graft could be required due to the fact that a delayed union, malunion or non-union is present. A delayed union is when the bone is healing more slowly than expected. A malunion is when the bones heal in an abnormal position. A non-union is when bone fusion fails to occur. There are many other reasons that a bone graft may be required such as a bone infection (osteomyelitis), joint replacement surgery, bone diseases like osteonecrosis, jaw reinforcement in dentistry or congenital anomalies like uneven limbs.

What are the types of bone grafts?

There are four types of bone graft a patient can obtain: autograft, allograft, bone marrow aspirate and synthetic bone graft.

Autograft

An autograft is a transplant that utilises the bone tissue of the patient also receiving the bone graft. The bone tissue used is generally taken from the top of the patient's hip bone (iliac crest). Using a patient's own tissue is advantageous due to the fact that it increases the chances of a successful fusion occurring, however the volume of bone that can safely be collected is limited and patients have been commonly known to experience long-term pain and discomfort at the donor site after the bone graft has been collected. The whole operation of an autograft will require two procedures: the first, to collect donor bone tissue and the second, to implant it. This increases the risk of infection and the length of the operation, which in itself introduces a number of extra risks to account for.

Allograft

An allograft is a transplant that utilises the bone tissue from another person (a donor). The risks associated with the prolonged operation and limited supply of donor bone tissue are entirely eradicated by using this type of bone graft, however this procedure holds a risk of immune rejection and due to the strict regulations around handling tissues that are upheld by public health services, the donor bone tissue is sterilised extremely efficiently in order to ensure the safety of the patient requiring the bone graft; all the processing of the donor bone tissue leads to reduced bioactivity and a reduction in its capacity to support further bone regeneration and healing.

Synthetic

A synthetic bone graft is a type of bone graft that is conducted through the use of artificial materials. These are made from a wide variety of porous substances, many also consist of proteins to further aid in bone development. The issue of a limited volume is not a problem with synthetic bone grafts, as they are entirely artificial and can be made upon request, furthermore, the risk of immune rejection has been found to be virtually zero. Additionally, researchers believe that it is possible to engineer the synthetic bone grafts to have the same level of bioactivity (if not better). This means that synthetic bone grafts will soon be both safer and have much improved efficacy, which will lead to faster healing along with the volume of patients experiencing complications that delay their recovery and may require further surgery significantly diminishing.

What are the types of bone grafts? (cotd.)

Bone Marrow Aspirate

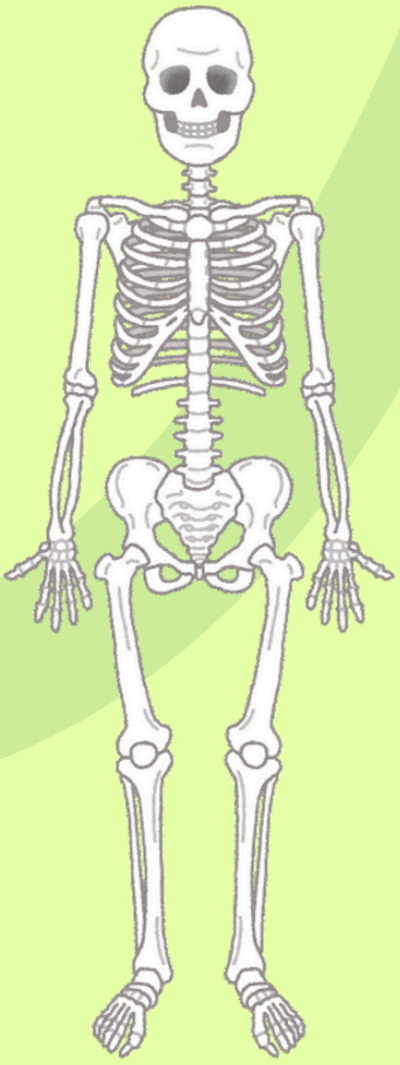
Bone marrow is located in the centre of bones, such as arms and thighs. This area of bone contains an individual's stem cells. Stem cells, while having the ability to differentiate, also have the capability to form new bone. The bone marrow is aspirated (the act of removing fluid or tissue using suction) with a needle, in a similar fashion to a blood test. The bone marrow is then used either solely or combined with other bone graft forms in order to enhance bone healing. As an individual ages, the volume of stem cells in the bones decreases, therefore for older adults the amount that can be collected is extremely limited. This procedure carries the same risks and benefits as an autograft.

Development of Synthetic Bone Grafts

Early attempts at synthetic bone grafts were found to be significantly unreliable and ineffective for their desired purpose. This was likely due to the fact that little was known about the way in which a human's body would respond to the synthetic materials being used and a lack of understanding as to how the materials needed to work synergistically with the patient's body in order to aid healing and remodelling. Researchers have worked tirelessly and solutions have been found. Nowadays synthetic bone grafts are formed from highly porous materials with a foam-like structure, which are generally ceramic-based. This imitates the internal tissue of bones. The synthetic bone graft stimulates that patient's bone cells to form new bone tissue. As stated by the Queen Mary University Research page, "Initially, this regenerated bone tissue incorporates the synthetic bone graft, but with time both the new tissue and scaffold may be remodelled and replaced with new more mature bone as part of the bone's constant cycle of regeneration and renewal." Further research conducted at Queen Mary's led to the launch of a new synthetic bone graft material in 2013. This new material took into account the necessary chemistry in order to successfully stimulate bone growth through the understanding of the hierarchical structure within natural bone. In 2019, this great achievement was recognised in a series of Royal Mail stamps that celebrated seven British engineering developments of the last fifty years,

Which type of bone graft is better for patients?

Due to the recent leaps made in the development of synthetic bone grafts, synthetic bone grafts have been deemed safer and more efficient than the alternatives previously used. This is due to the fact that the risk of immune rejection is entirely eradicated with the use of a synthetic bone graft and there are fewer risks in the actual operation, this is owing to the fact that there is no need for two parts to the procedure as is necessary for an autograft (which initially requires the collection of donor bone tissue from a secondary surgical site) this reduces the need for long periods under anaesthesia and also means that the patient will not have an extra donor site causing them long-term discomfort. Mr Michael Mokawem, Consultant Spinal Surgeon, Royal National Orthopaedic Hospital NHS Trust reported an impressive 98.9 per cent fusion rate in surgery, when using the synthetic material of InductigraftTM.



Patients were also found to be released an average of two or three days earlier than is usual, this in itself improves the quality of life for patients while also reducing healthcare costs helping with the overall economical state of the NHS.

References

Queen Mary University of London Research (2022) Hard graft: How Queen Mary research created a landmark range of synthetic bone-graft materials [online] Available at: https://www.qmul.ac.uk/research/featured-research/hard-graft-how-queen-mary-research-created-a-landmark-range-of-synthetic-bone-graft-materials/ [Accessed 26. 06. 2025]

John Hopkins Medicine (2024) Bone Grafting [online] Available at: https://www.hopkinsmedicine.org/health/treatment-tests-and-therapies/bone-grafting [Accessed 26. 06. 2025]

OrthoInfo (2021) Bone Grafts in Spine Surgery [online] Available at: https://orthoinfo.aaos.org/en/treatment/bone-grafts-in-spine-surgery/ [Accessed 26. 06. 2025]

Cleveland Clinic (2023) Bone Grafting [online] Available at: https://my.clevelandclinic.org/health/treatments/16796-bone-grafting [Accessed 26. 06. 2025]

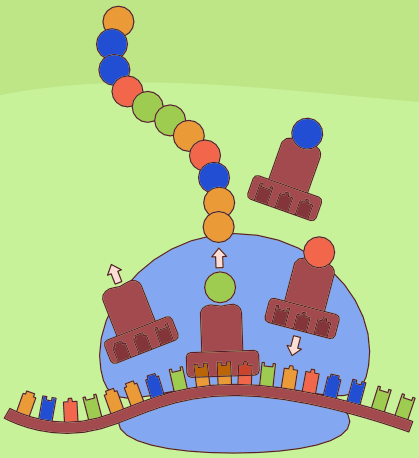
By Ziyanna FW

Rewriting the code of life: Gene editing's revolution in medicine

Gene editing — short for genome editing — is the remarkable ability to make precise, targeted modifications to the DNA sequence of a living organism. In essence, it allows scientists to rewrite the genetic code, altering an organism's fundamental biology in ways that were once the realm of science fiction.

Cue Ellie: an 18-year-old girl with a severe, potentially life-threatening allergy to tomatoes. In most cases, this might be manageable. But Ellie lives in a world saturated with tomatoes: in pizza, salads, spaghetti Bolognese—even in crisps. Every trip to the supermarket or dinner out becomes a mission of vigilance. She pores over ingredients lists, questions waitstaff, and clings to fleeting hope — only to have it demolished by two bold words: **contains tomatoes.**

After years of frustration and the heartbreaking inability to set foot into pizza hut, Ellie is desperate for a solution. Then one day, she stumbles upon a newspaper headline: **"Gene Editing Used to Remove Allergens."** At last, it seems, the universe might be answering her call. But before she can truly understand the implications, Ellie must first explore the science behind this groundbreaking technology.



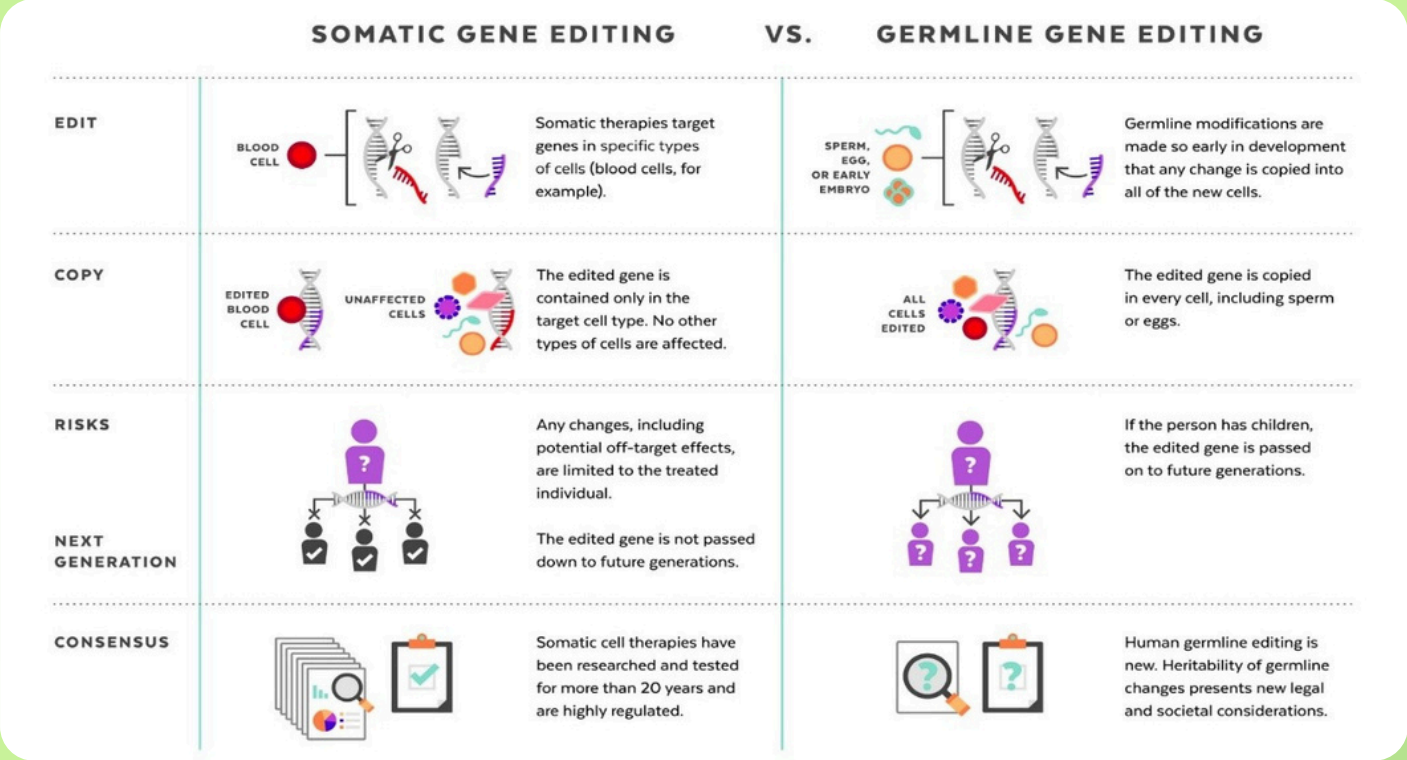
Gene editing can be described as the precise alteration of an organism's genetic material. DNA sequences can be inserted, deleted, modified, or replaced — essentially reprogramming the genome. This process is typically facilitated by engineered enzymes known as nucleases, which are designed to target specific DNA sequences. These enzymes cut the DNA strand at designated sites, allowing scientists to remove faulty sections and replace them with corrected or modified genetic code.

Gene therapy is a cutting-edge technique that employs genetic material to treat or prevent disease. It involves introducing genes into a patient's cells to either correct a defective gene or insert a new one capable of producing a beneficial protein, thereby aiming to restore normal function or halt disease progression. This can be achieved by adding a functional copy of a gene, silencing a malfunctioning gene, or modifying the expression of an existing one.

While gene therapy and gene editing share the overarching goal of combating disease through genetic alteration, they diverge in their methodologies. Gene therapies typically entail the addition of an exogenous gene to compensate for a dysfunctional one, whereas gene editing precisely modifies the existing DNA sequence within the genome. In this context, gene editing can be considered a subset of gene therapy — distinguished by its targeted approach to altering native DNA rather than supplementing it.

There are two types of gene therapies that are somatic gene therapy and germline gene therapy. In the former, gene and cell therapy strategies primarily target **somatic cells** — the cells that constitute most of the body's tissues, excluding the reproductive cells (sperm and eggs). There is broad consensus among scientists, bioethicists, and other stakeholders that gene therapy, including gene editing of somatic cells, represents an ethically acceptable and potentially transformative approach for treating a range of diseases.

To understand **germline gene editing**, it is important to first clarify some key concepts. **Germline cells**, or reproductive cells, refer to the sperm and egg cells that transmit genetic information from one generation to the next. Germline gene editing entails modifying the DNA of these cells — or of early-stage embryos (typically within five days post-fertilization) — in a laboratory setting. This process involves removing, correcting, or altering specific segments of DNA to eliminate or repair inherited genetic defects before they can be passed on to future generations.



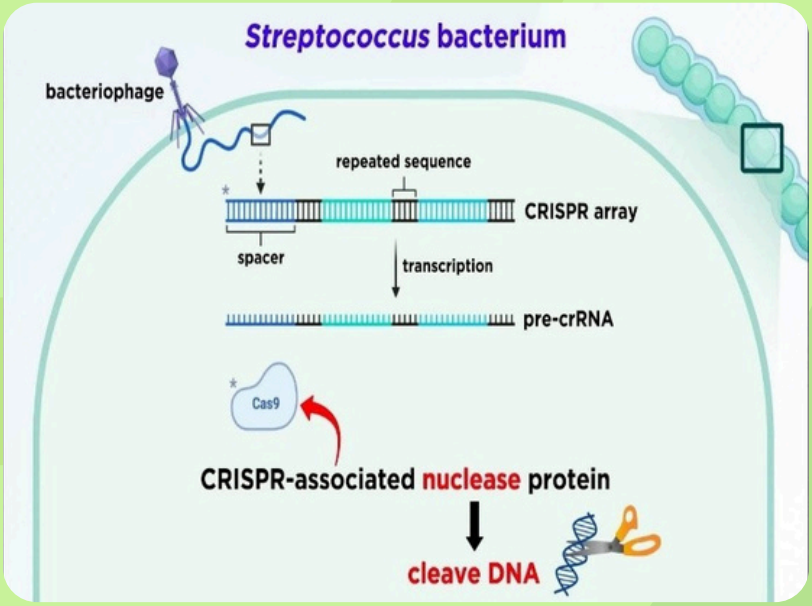
Gene editing refers to the precise modification of an organism's DNA, enabling scientists to alter genetic sequences with exceptional accuracy. Among the primary techniques employed are Zinc Finger Nucleases (ZFNs), Transcription Activator-Like Effector Nucleases (TALENs), and the CRISPR-Cas systems — of which CRISPR-Cas9 has emerged as the most prominent due to its remarkable efficiency, simplicity, and versatility. These advanced tools facilitate targeted genetic alterations, including the insertion, deletion, or replacement of specific DNA sequences, thereby offering unprecedented control over the genetic code.

The foundations of gene editing were laid in the 1950s with the discovery of DNA's double helix structure. As researchers delved deeper into the workings of genetics, they uncovered a critical insight: the sequence of DNA bases is hereditary, passed from parent to offspring, and small changes —mutations — in that sequence can determine whether a person is healthy or affected by disease.

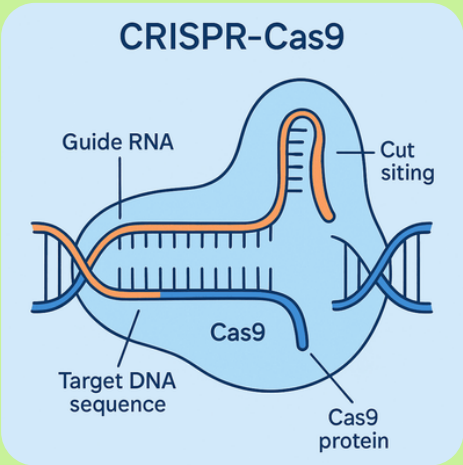
This realization sparked a transformative vision in molecular biology. If genetic errors could be identified and pinpointed, could they not also be corrected? This notion laid the groundwork for what would eventually become gene therapy. By the 1980s, scientists regarded the potential to fix flawed DNA as a kind of "holy grail" in genetic medicine.

The development of gene editing technology to what it has evolved into now, was not a fast and easy approach. Instead, early progress focused on providing a copy of the mutated gene either inserted into the genome or maintained as an extrachromosomal unit, and whilst this approach was effective for certain conditions it was deemed too complicated and limited in its ability. The researchers aimed to create a double-stranded break in DNA at precisely the desired location in more than three billion base pairs that constitute the human genome. Once created the double-stranded break could be efficiently repaired by the cell using a template that directed replacement of the “bad” sequence with the “good” sequence. However, making this initial break was not easy.

Before the revolutionary CRISPR-Cas9, site-specific DNA editing relied on zinc finger nucleases (ZFNs) and transcription activator-like effector nucleases (TALENs). Both systems use engineered proteins to induce double-stranded DNA breaks via the Fok1 nuclease. ZFNs are composed of zinc finger domains that recognize short DNA sequences, typically three to four base pairs each. Multiple domains are linked to target longer sequences, and paired ZFNs bind opposite strands to position Fok1 subunits for cleavage. TALENs function similarly but use DNA-binding domains derived from plant pathogens, making them easier to engineer for longer sequences. Like ZFNs, they require two proteins flanking the target site to activate Fok1 and induce a cut.

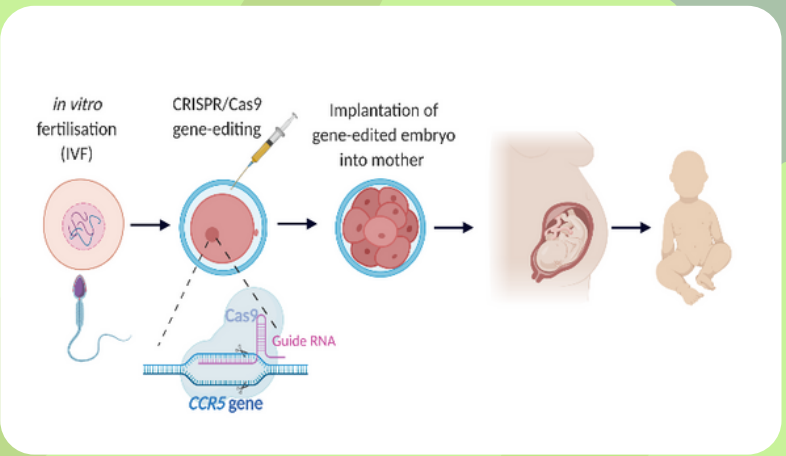


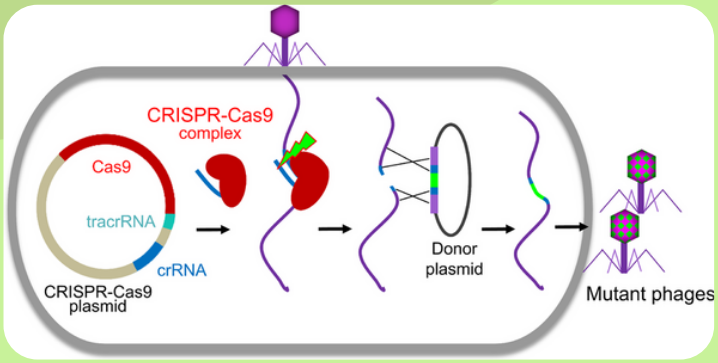
CRISPR-Cas9 Genome Editing Technology, PictureCRISPR-Cas9, short for clustered regularly short palindromic repeats and CRISPR-associated protein 9, was adapted from a naturally occurring genome editing system that bacteria use as an immune defence. When bacteria are infected with viruses, they seize tiny fragments of the viruses' DNA and weave them into their own DNA in specific patterns to form what are called CRISPR arrays. The bacteria can "remember" the viruses (or similarly related ones) thanks to the CRISPR arrays. If the viruses re-attack, the bacteria employ the CRISPR arrays to create RNA segments that identify and bind to DNA sequences of the viruses. The virus is then rendered inoperable by the bacteria's employment of Cas9 or a related enzyme to split the DNA.



This immune defence mechanism has been modified by researchers to change DNA. Like the RNA segments bacteria generate from the CRISPR array, they produce a tiny bit of RNA with a brief "guide" sequence that binds (attaches) to a particular target region in a cell's DNA. Additionally, this guide RNA binds to the Cas9 enzyme. The Cas9 enzyme cuts the DNA at the precise spot after the guide RNA, which mimics the process in bacteria, identifies the desired DNA sequence when it is introduced into cells. While Cas9 is the most used enzyme, other enzymes, such as Cpf1, can also be employed. Researchers can alter the DNA by substituting a specific DNA sequence for an existing segment or by adding or removing genetic information using the cell's own DNA repair machinery after the DNA has been cut.

In 2015, the Cpf1 (now known as Cas12a) system further advanced the field. Unlike Cas9, Cpf1 requires only a single guide RNA and creates staggered rather than blunt cuts, potentially offering more precise control for inserting new genetic material. Ongoing discoveries of diverse microbial nucleases continue to expand the toolkit, offering new possibilities for more refined, flexible gene-editing strategies.





The new technology of CRISPR -Cas9 can be used and has been used in a variety of ways, for example being applied to early embryos to create genetically modified organisms. It has also been injected into the bloodstream in laboratory animals to achieve substantial gene editing in subsets of tissues. Scientists have even been able to develop methods to destroy antibiotic-resistance bacteria by modifying the genomes of bacteriophages, which are bacteria killing viruses, with CRISPR-Cas9 technology.

In 2015, a group of scientists, including Jennifer Doudna, called for caution in applying CRISPR-Cas9 technology to human subjects, urging that its use be deferred until the safety and ethical ramifications of human gene editing were thoroughly evaluated. In contrast, some researchers advocated for an accelerated adoption, contending that the technology held transformative potential to alleviate human suffering and that delaying its implementation could itself be considered unethical.

Around the same period, reports emerged from China indicating that gene-editing experiments had been conducted on human embryos. This resulted in a 2018 announcement by a Chinese scientist who claimed the birth of the world's first gene-edited infants—twin girls whose genomes had been altered to confer resistance to HIV infection. These developments, both celebrated and condemned, were seen as a pivotal moment, one that could fundamentally reshape the trajectory of human genetics.

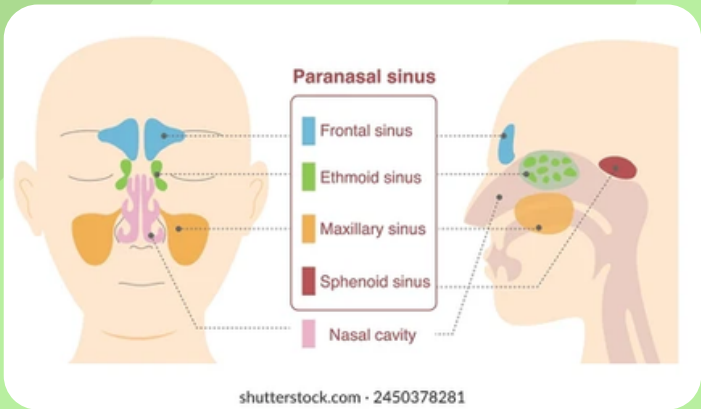
Despite the life changing work of gene editing, there are some ethical issues and potential concerns that arise when thinking of this method of saving lives.

Therefore, whilst gene editing may raise ethical concerns, its continued advancement holds in the promise of transforming countless lives for the better and stands poised to play a pivotal role in saving the millions more in the years to come.

By Tanusha Ganes

Advances in Endoscopic Sinus Surgery

Endoscopic sinus surgery (ESS) represents a major leap forward in the treatment of chronic rhinosinusitis (CRS) and other sinonasal disorders. Since its introduction in the 1980s, this minimally invasive technique has evolved significantly due to technological advances and improved understanding of sinonasal anatomy and physiology. As a result, ESS has become safer, more precise, and applicable to a broader range of conditions, ultimately leading to better outcomes and quality of life for patients.



Historical Background and Functional Concept

ESS was developed as a response to the limitations of traditional open sinus surgeries, which often involved extensive tissue removal and high morbidity. The functional endoscopic sinus surgery (FESS) approach, based on the work of Messerklinger and others, introduced the idea of preserving mucosa and restoring natural sinus drainage pathways. By using nasal endoscopes and high-resolution imaging, surgeons could directly visualize and treat the underlying pathology with greater precision.

Technological Innovations in ESS

High-Definition Imaging and Visualization

The advent of high-definition (HD) and ultra HD (4K) endoscopy systems has significantly enhanced intraoperative visibility. Surgeons can now distinguish finer anatomical details, reducing the risk of complications and enabling more accurate dissection, particularly in anatomically complex or scarred sinuses.

Powered Instrumentation and Microdebriders

Powered instruments, particularly microdebriders, have become standard tools in ESS. These devices combine suction and rotation to remove polyps and diseased tissue with minimal trauma. Compared to traditional forceps, microdebriders offer improved control and reduce bleeding, which enhances the surgeon's ability to maintain a clear surgical field (Khalid & Mace, 2010).

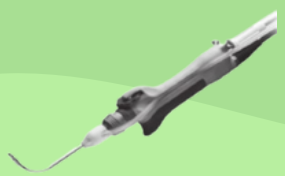


Image-Guided Navigation Systems

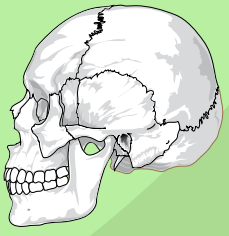
Image-guided surgery (IGS), also known as surgical navigation, uses CT or MRI data to provide real-time localization of instruments during ESS. This technology is especially useful in revision surgeries or when working near critical structures like the orbit or skull base. Clinical studies have shown that IGS enhances surgical confidence and reduces the risk of major complications (Javer et al., 2008).

Balloon Sinuplasty

Balloon catheter dilation, or balloon sinuplasty, is a minimally invasive alternative that involves dilating the sinus ostia without removing bone or mucosa. This approach is particularly useful for select patients with isolated frontal or maxillary sinus disease and has been associated with shorter recovery times and less postoperative discomfort. However, its long-term efficacy is still being evaluated (Levine et al., 2008).

Expanded Indications and Techniques

Endoscopic Skull Base Surgery



The endoscopic approach has expanded beyond the sinuses into the skull base. Surgeons now use transnasal endoscopic methods to access and treat cerebrospinal fluid (CSF) leaks, pituitary tumors, and other intracranial pathologies. This has significantly reduced the need for open craniotomies, leading to lower morbidity and faster recovery (Harvey et al., 2008).

Management of Orbital and Lacrimal Disorders

ESS is now commonly used in orbital decompression for thyroid eye disease and for treating orbital abscesses or tumors. Endoscopic dacryocystorhinostomy (DCR) is also a well-established technique for treating nasolacrimal duct obstruction, offering comparable success to external DCR with superior cosmetic outcomes.

Patient Outcomes and Quality of Life

Recent studies indicate that ESS significantly improves symptoms, disease-specific quality of life, and productivity in patients with CRS. According to Smith et al. (2005), most patients report substantial improvements in nasal congestion, facial pain, and overall well-being after surgery. Additionally, endoscopic approaches minimize tissue trauma, which often translates to reduced bleeding, faster healing, and lower complication rates. Postoperative care has also improved with the introduction of drug-eluting stents, absorbable packing materials, and structured saline irrigation protocols, all of which contribute to maintaining sinus patency and reducing recurrence rates.

Future Directions

The future of ESS lies in further integration of digital and robotic technologies. Artificial intelligence (AI) may play a role in preoperative planning and intraoperative decision-making, while robotic systems could improve precision in confined anatomical spaces. Augmented reality (AR) tools are also under development, potentially allowing surgeons to superimpose anatomical imaging directly onto the endoscopic view during surgery. Biologic therapies, such as monoclonal antibodies targeting type 2 inflammation in nasal polyps, are also reshaping the treatment landscape. As these therapies become more common, the role of ESS may shift toward more targeted or combination-based treatment strategies.

Conclusion

Endoscopic sinus surgery has transformed from a novel concept into a cornerstone of modern rhinology. Technological and procedural advancements have broadened its application, improved patient outcomes, and reduced complication rates. As innovation continues, ESS is poised to become even more precise, personalized, and integrated with medical therapy, offering new hope for patients with both inflammatory and complex sinonasal diseases.

References

Harvey, R. J., Shelton, W., Timperley, D., & Schlosser, R. J. (2008). The role of image-guided surgery in revision endoscopic sinus surgery. American Journal of Rhinology, 22(5), 511-517. https://doi.org/10.2500/ajr.2008.22.3219

Javer, A. R., & Genoway, K. A. (2008). Patient satisfaction and revision rates after endoscopic sinus surgery. American Journal of Rhinology, 22(1), 38-43. https://doi.org/10.2500/ajr.2008.22.3122

Khalid, A. N., & Mace, J. C. (2010). Clinical outcomes after endoscopic sinus surgery in patients with chronic rhinosinusitis and asthma. American Journal of Rhinology & Allergy, 24(1), 37-41.https://doi.org/10.2500/ajra.2010.24.3401

Levine, H. L., Sertich, A. P., Hoisington, D. R., Weiss, R. L., & Pritikin, J. (2008). Multicenter registry of balloon catheter sinusotomy outcomes for 1,036 patients. Annals of Otology, Rhinology & Laryngology, 117(4), 263- 270. https://doi.org/10.1177/000348940811700404

Smith, T. L., Litvack, J. R., Hwang, P. H., Loehrl, T. A., Mace, J., & Fong, K. (2005). Determinants of outcomes of sinus surgery: A multi-institutional prospective cohort study. Otolaryngology-Head and Neck Surgery, 132(2), 314-320. https://doi.org/10.1016/j.otohns.2004.09.011

By Lakshana R

A New Era Of Artificial Intelligence Assisted Healthcare

Introduction

As demand for quality healthcare continues to rise at a rapid and often unsustainable pace, countless people all around the globe encounter many obstacles to achieving better health - ranging from late test results to fatal misdiagnoses. As the digital age continues to evolve with numerous technological advancements, an increased number of individuals are turning to online tools and platforms as their primary source of medical advice, information, and emotional support. Whether it's using symptom checkers from online apps or accessing virtual consultations with AI chatbots, digital resources have become a crucial part of people's both mental and physical well-being.

AI in Healthcare

Microsoft has recently come up with an AI based solution Microsoft's AI Diagnostic Orchestrator (MAI-DxO), which when benchmarked against case records from the New England Journal of Medicine, correctly diagnoses up to 85% of cases—over four times the accuracy of experienced physicians. With more than 50 million daily health-related sessions across Bing and Copilot, AI is becoming a vital front line in healthcare. Despite scoring near-perfect results on exams like the USMLE, generative AI still faces challenges in demonstrating deep clinical understanding beyond memorised multiple-choice formats.

Each week, the New England Journal of Medicine (NEJM)—a leading peer-reviewed medical publication—features a Case Record of the Massachusetts General Hospital, presenting a detailed clinical description of a patient's diagnostic journey. These cases represent some of the most diagnostically challenging scenarios in modern medicine, frequently needing collaboration and advanced diagnostic methods to reach a conclusive diagnosis.

When an evaluation of generative AI models was conducted using 304 diagnostically complex cases from the New England Journal of Medicine. The models assessed included GPT, Llama, Claude, Gemini, Grok, and DeepSeek. When paired with Microsoft's AI Diagnostic Orchestrator (MAI-DxO), diagnostic performance improved across all models. The highest-performing AI—MAI-DxO along with OpenAI's O3—correctly solved 85.5% of benchmark cases. For comparison, a group of 21 experienced physicians from the US and UK (each with 5-20 years of clinical practice) achieved an average accuracy of just 20% on the same evaluation set.

MAI-DxO is built to work within set budget limits, which helps it make smart choices about which medical tests are worth doing. Without these limits, an AI system might suggest every possible test — even if some are expensive, uncomfortable for the patient, or slow down care. But in our study, MAI-DxO gave more accurate diagnoses while also saving money compared to doctors or other AI tools.

Benefits envisaged

Clinicians each have their own specialties, so no one individual can handle every type of complex case. MAI-DxO doesn't have that problem. It combines knowledge and information from many areas and uses strong reasoning to understand even the most clinically challenging medical cases—often doing better than any single expert could. By using AI for routine tasks like symptom tracking, medication reminders, or interpreting basic test results, patients can take a more active role in managing their own health. And when it comes to complicated or rare cases, AI systems like MAI-DxO can support clinicians with deeper analysis, faster diagnostics, and broader expertise. There's also enormous potential to curb wasteful spending. With U.S. healthcare costs approaching 20% of GDP—and estimates suggesting up to 25% of that is unnecessary—AI-guided decision-making could help eliminate redundant tests, reduce misdiagnoses, and streamline care delivery.

Conclusion

As global healthcare systems face increasing pressures, digital platforms are increasingly filling huge gaps in global medical access and increased efficiency. Tools like AI symptom checkers and virtual consultations with chatbots are redefining healthcare delivery. Marking a shift toward more accessible healthcare, and patient-focused models of care both greatly benefit both the clinician and patient. The goal is to give clinicians quicker access to information they need to treat patients, with initial efforts aimed at developing a model that automatically generates reports for a patient's X-ray, as well as detecting changes from prior images. This could improve how clinicians work and care for patients by providing more efficient and comprehensive analyses of X-rays and medical test reports.

By Anvesha G

Using gene therapy to cure genetic diseases

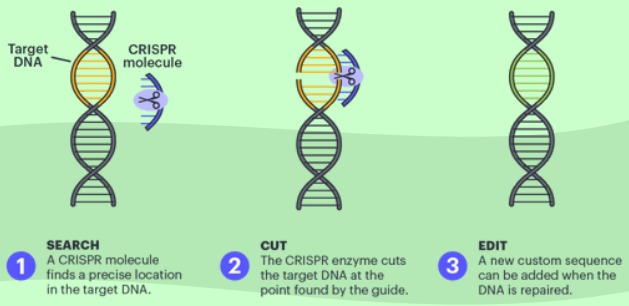
What is CRISPR?

CRISPR stands for Clustered Regularly Interspaced Short Palindromic Repeats (1) - it's a component of bacterial immune systems, where it cuts the DNA of invading viruses called bacteriophages. Bacteria have been shown to incorporate some of the viruses or other invader's DNA into its own DNA, so it can recognise it again in the future (2).

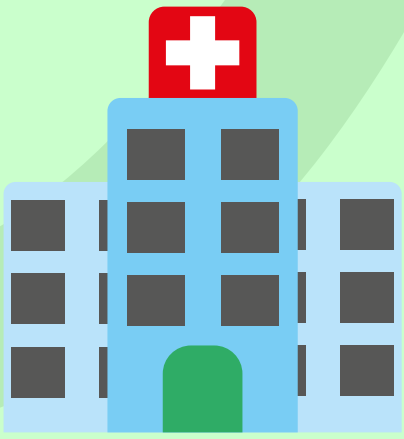
It has since been repurposed as a gene editing test. It can cut a target DNA sequence directed by a customisable guide.

How does CRISPR work?

CRISPR contains 2 components - an enzyme (spCas9) and a guide RNA (gRNA). A complementary gRNA is produced, which guides the Cas9 enzyme to the specific area of the gene. The enzyme can now 'cut' the DNA at the correct area. The cell then proceeds to fix the broken DNA, by using non-homologous end-joining or homology directed repair. Non-homologous end joining is when the cell introduces small insertions or deletions, which disrupts the gene function and causes it to become non-functional. Homology directed repair is when the cell inserts a new gene or corrects a mutation, allowing it to repair the break. It needs a template DNA strand with the desired sequence.



The story of KJ



- KJ is an infant who was born with a rare metabolic disease - carbamoyl phosphate synthetase I (CPS1) deficiency.
- He was treated at the Children's Hospital of Philadelphia (CHOP) and Penn Medicine.
- His diet initially had to be restricted to make sure he didn't consume too much protein. He was too young for a liver transplant (3).
- CHOP physician-scientist Rebecca Ahrens-Nicklas, MD, PhD proposed using a personalised CRISPR gene editing therapy to correct the mutation in the CPS1 gene. He received 2 doses of base editor bound to a bespoke targeting guide sequence using lipid nanoparticles.
- He received his first dose of bespoke therapy in February 2025, when he was 6-8 months old. The treatment was administered safely and now is thriving.
- After 7 weeks of receiving the 2 doses, his condition began significantly improving and was able to tolerate a greater amount of protein and required less medication (4).

CPS1 deficiency

CPS1 is an inherited disorder which causes ammonia to accumulate in the blood – this is called hyperammonaemia. Ammonia is a toxic compound, and the brain is especially sensitive to this. In the first few days of life, an infant with CPS1 deficiency shows hyperammonaemia symptoms. These include:

- Unusual sleepiness
- Poor regulation of breathing and body temperature
- Unwillingness to feed and vomiting after feeding
- Unusual body movements
- Seizures
- Coma
- It can also lead to developmental and intellectual disability.

CPS1 symptoms can also appear later in life.

What is CPS1 caused by?

It's caused by mutations in the CPS1 gene. The CPS1 gene contains instructions to make carbamoyl phosphate synthetase I. It is an enzyme that participates in the urea cycle (it helps process excess nitrogen from when proteins are broken down to make urea). It controls the very first step of the cycle when excess nitrogen compounds are incorporated into the cycle to be processed. In CPS1 deficiency, low levels or no enzyme is produced, so nitrogen accumulates in the form of ammonia (toxic) and cannot be excreted (5).

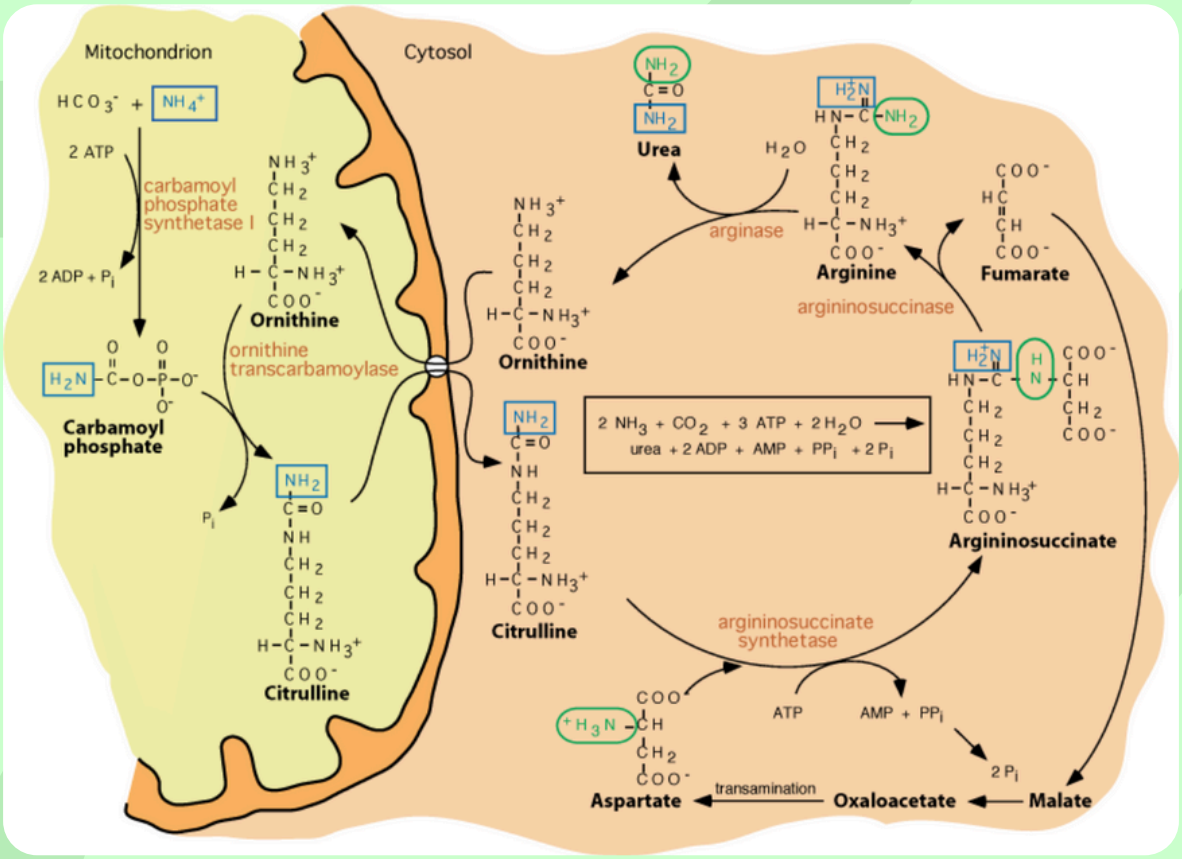


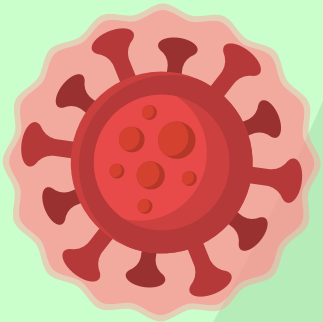
Figure 1 - a figure showing the urea cycle

Typical management strategies include having a low protein diet (6), taking medication such as sodium benzoate or sodium phenylacetate (7), which can remove ammonia, or in the most severe cases having a liver transplant (8).

Gene editing to treat other genetic disorders

Pros	Cons
Provides options – for diseases with no other cure, this can be promising for them.	Expensive – technology is still new. This means that it is inaccessible for most people. (e.g. Vyjuvek the first topical gene therapy to treat dystrophic epidermolysis bullosa, can be as high as $15-22m per person).
Only needs to be carried out once to treat someone – long lasting.	Experimental so potentially dangerous – concerns if the treatment reaches other non-faulty cells, whether it will actually cause harm to those cells/cause infection.
Faulty genes are not passed down to children (10).	Ethical issues – difficult to classify whether use of gene therapy is good/bad in certain circumstances (10).

Gene editing is shown to be really promising in treating some genetic disorders (such as cystic fibrosis, muscular dystrophy, Huntingdon's diseases and various blood disorders) and other diseases like HIV/AIDS and cancer. However, there are still concerns around these, as it is still quite new (9).



References

1) Synthego, What is CRISPR: The Ultimate guide to CRISPR Mechanisms, Application, Methods & More. Available at: https://www.synthego.com/learn/crispr

2) Stanford University, Stanford explainer: CRISPR, Gene Editing and beyond. Available at: https://news.stanford.edu/stories/2024/06/stanford-explainer-crispr-gene-editing-and-beyond#what-CRISPR

3) Children's Hospital of Philadelphia, World's First Patient Treated with Personalized CRISPR Gene Editing Therapy at Children's Hospital of Philadelphia. Available at: https://www.chop.edu/news/worlds-first-patient-treated-personalized-crispr-gene-editing-therapy-childrens-hospital

4) Grinstein, J.D. First Personalized CRISPR Gene Editing Therapy Patient Baby KJ Discharged. Available at: https://www.insideprecisionmedicine.com/topics/precision-medicine/first-personalized-crispr-gene-editing-therapy-patient-baby-kj-discharged/

5) Medline Plus, CPS1 Gene. Available at: https://medlineplus.gov/genetics/gene/cps1/

6) Baby's first test, Carbamoyl Phosphate Synthetase 1 deficiency. Available at: https://www.babysfirsttest.org/newborn-screening/conditions/carbamoyl-phosphate-synthetase-i-deficiency

7) Roth, K.S. Carbamoyl Phosphate Synthetase (CPS) Deficiency Treatment & Management. Available at: https://emedicine.medscape.com/article/942159-treatment#:~:text=Medical%20Care,Depending%20on%20clinical&text=Initiate%20intravenous%20infusion%20of%2010,administered%20with%20benzoate%20and%20phenylacetate.

8) Myriad, Carbamoyl phosphate Synthetase I Deficiency. Available at: https://myriad.com/womens-health/diseases/carbamoylphosphate-synthetase-i-deficiency/

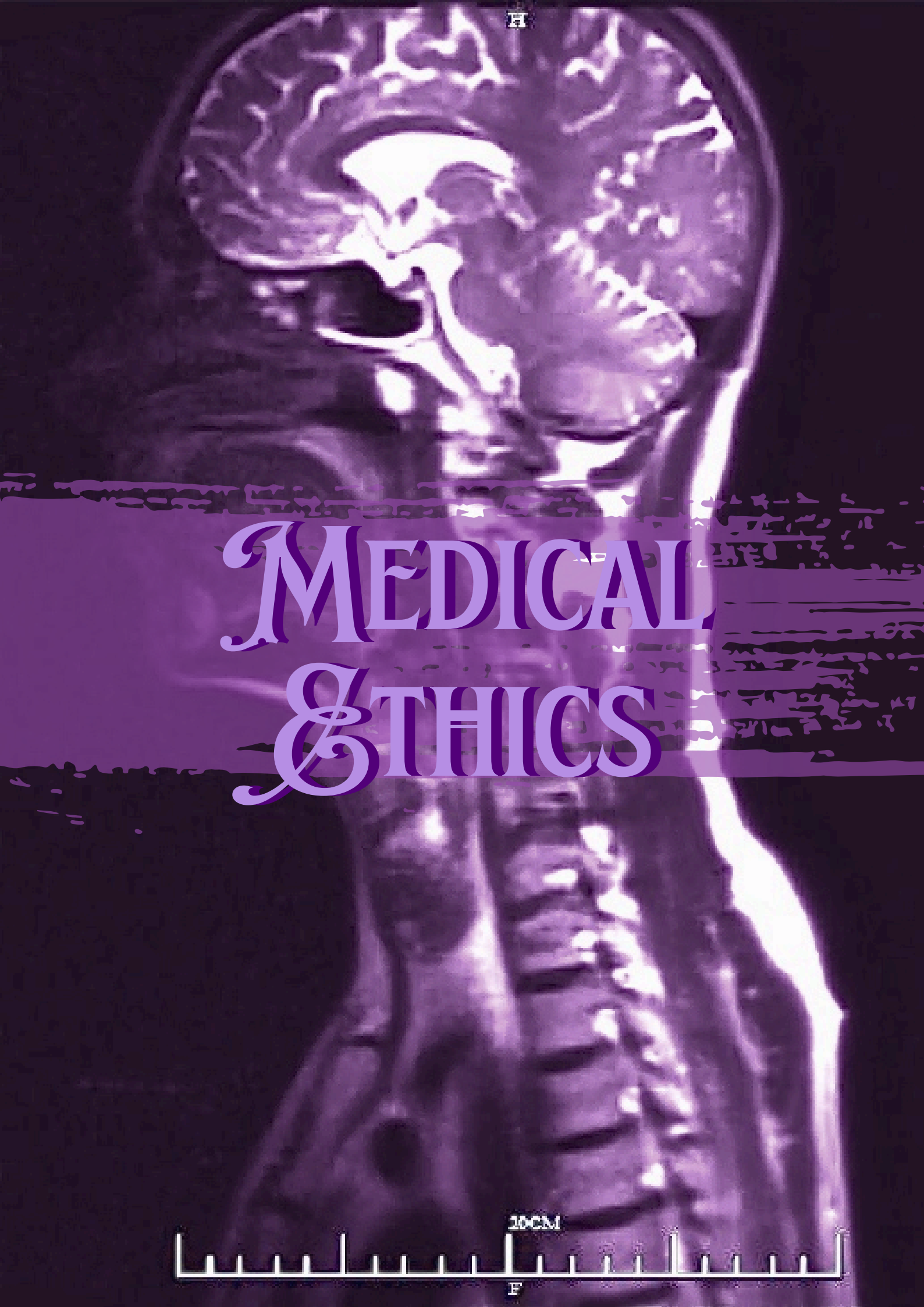
9) Fernandez, C.R. Seven diseases CRISPR technology could cure. Available at: https://www.labiotech.eu/in-depth/crispr-technology-cure-disease/#crisprforaids

10) Gragnolati, A.B. What Are the Pros and Cons of Gene Therapy? Available at: https://www.goodrx.com/health-topic/gene-therapy/gene-therapy-pros-cons

Figures:

Figure 1: NYU Langone Health, Urea Cycle. Available at: https://education.med.nyu.edu/mbm/aminoAcids/ureaCycle.shtml

By Mahilzini B



Medical Ethics

Medical Ethics in Modern Medicine: Balancing Progress, Compassion, and Responsibility

In a world where technology is advancing rapidly, genetic editing and AI-driven diagnostics are becoming increasingly normalized, the need for strong, clear, and compassionate medical ethics is more important than ever. Medical ethics form the backbone of patient care, ensuring that the practice of medicine remains humane, responsible, and thriving in dignity. But what does that mean today?

The Four Pillars of Medical Ethics

Medical ethics is generally guided by four core principles: autonomy, beneficence, non-maleficence, and justice.

- Autonomy emphasizes the patient's right to make decisions about their own body and treatment. This is especially important in end-of-life care, informed consent, and reproductive decisions.
- Beneficence means acting in the patient's best interest, providing care that helps, not harms.
- Non-maleficence, the principle behind the famous phrase "do no harm," compels healthcare providers to avoid treatments or interventions where the potential for harm outweighs the benefit.
- Justice concerns fairness in medical decisions—how we allocate limited resources, how we ensure equal access to care, and how we avoid discrimination.

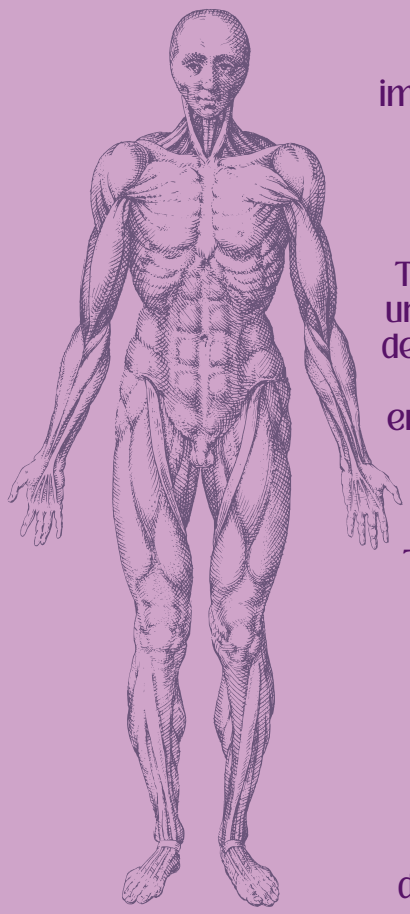
Balancing these principles may seem easier said than done. Think about a terminally ill patient requesting assisted dying. Autonomy says we respect their wishes. Non-maleficence urges caution. Justice asks whether this option is equally available to all. Beneficence raises the question: Is helping someone die a form of helping?

Ethics in Genetic Engineering

The introduction of CRISPR and other genetic technologies has opened new possibilities—but also new ethical risks. On one hand, gene editing could eliminate inherited diseases like cystic fibrosis or sickle cell anaemia. On the other hand, it raises public concerns about "designer babies," inequality, and long-term effects we still aren't able to predict.

Critics argue that genetic editing may lead to misuse, such as selecting traits unrelated to health—such as intelligence or appearance—leading to deeper social inequality. There are also concerns about consent, especially when changes affect future individuals who cannot give permission. As these technologies progress, medical ethics must ensure they are applied with caution, oversight, and fairness, focusing on treatment and prevention rather than enhancement.

Should we edit embryos to prevent suffering? Who decides what's acceptable? These questions go beyond science—they're deeply ethical.



Ethics and Artificial Intelligence

Day by day, AI is transforming healthcare–from scanning medical images to predicting outcomes. It can help diagnose disease faster and in some cases, more accurately than a human doctor. But with this power comes risk.

Who is responsible if an AI makes the wrong decision?

There is a growing need to ensure that such systems are transparent, unbiased, and used under human supervision. The authority of medical decisions to algorithms must never override professional responsibility or patient-centred care. Accountability remains essential; when an error occurs, the source must be clearly identified, and the patient has every right to have a reasonable explanation of who made a mistake.

Global Health and Vaccine Ethics

The visible difference that wealthy countries and LIC's receive when it comes to global health is a big issue. For example, the COVID-19 pandemic brought global health ethics into the spotlight. While wealthier countries secured millions of vaccine doses, many low-income countries struggled to get even basic access.
Medical ethics played a central role in international discussions about vaccine sharing, patent rights, and global cooperation. Justice demanded that lifesaving treatments be made accessible to all, regardless of geography or economic power. Ethical decision-making during global health crises must prioritise fairness and the prevention of avoidable suffering.

Patient Data and Digital Privacy

The shift to digital healthcare has brought new ethical responsibilities around data use and patient confidentiality. Electronic health records, health apps, and wearable devices collect large amounts of personal data, some of which is shared with third parties for research or commercial purposes.
Protecting patient privacy in this environment requires strong safeguards. Consent must be informed, clear, and ongoing. Healthcare systems must ensure that patient data is not only stored securely, but used ethically, with full transparency about who has access and why. Privacy is a core ethical obligation that reinforces trust in healthcare providers.

Ethical Challenges at the End of Life

End-of-life decisions are often the most emotionally charged and morally complex challenges in medicine. Advances in life-support technology can extend life even when recovery is unlikely, creating difficult conversations about when and how to withdraw treatment. Ethical practice in this context make sures the principles of autonomy, beneficence, and non-maleficence are all balanced. Patients may express a desire to refuse further intervention or choose palliative care to reduce suffering. In some jurisdictions, assisted dying has become legal under strict conditions, which spark ethical discussions even more. Regardless of legal context, the focus should remain on dignity, informed decision-making, and compassionate support for patients and families.

Training Doctors to Think Ethically

Medical ethics isn't just learned from books. It must be practised, discussed, and reflected on constantly. That's why medical schools today include ethics as a core part of the curriculum. Case-based learning, reflective writing, and discussions of real-world scenarios prepare students to apply ethical principles in practice.

But the learning doesn't stop there. Hospitals must support ethical practice through clear policies, open discussion, and ethics committees to guide decisions. Being a doctor today means not just being technically skilled—but morally aware.

Conclusion: Medicine as a Moral Practice

Medical ethics is not a list of rules—it's a mindset. It's about listening to patients, questioning our actions, and putting people before procedure. It ensures that as medicine evolves, we never lose our humanity along the way. As I myself one day hope to work in the medical field, I believe moral practice is the base of all actions taken. Patience and doctors are both real people and it important to try out best to preserve the gift of life.

In the end, the question isn't just "What can we do?" but "What should we do?" Medical ethics is what helps us find the answer .

By Harini A

Sources:

Beauchamp, T. L., & Childress, J. F. (2019). Principles of Biomedical Ethics (8th ed.). Oxford University Press.

World Health Organization. (2021). Ethics and COVID-19: Resource Allocation and Priority-Setting. Retrieved from: https://www.who.int

Gillon, R. (1994). Medical ethics: four principles plus attention to scope. BMJ, 309(6948), 184–188.

British Medical Association. (2022). Ethics Toolkit for Medical Students. Retrieved from: https://www.bma.org.uk

The Nuffield Council on Bioethics. (2018). Genome Editing and Human Reproduction: Social and Ethical Issues. Retrieved from: https://www.nuffieldbioethics.org

6. The Nuffield Council on Bioethics. (2018). Genome Editing and Human Reproduction: Social and Ethical Issues. Retrieved from: https://www.nuffieldbioethics.org

The Medical Ethics of Squid Game - Part 1

If you somehow missed the global phenomenon that had half the world questioning their trust in playground games -let's catch you up.
"Squid Game" is a South Korean survival drama that dropped on Netflix instantly blew up. Picture this: 456 players, all drowning in debt, desperate for a second chance at life- and offered the chance to win a life-changing ₩45.6 billion (that's about £28 million!).

The catch?
They have to survive a series of creepy, twisted childhood games.
The price of losing? Instant, brutal death.

It's The Hunger Games x10, with a splash of Playground childhood Trauma.
But here's the thing - beneath the shocking deaths and candy-coloured chaos is a terrifyingly real story about poverty, desperation, and how society quietly kills the vulnerable.

It's not just a show.
It's a metaphor.
And it hits a little too close to home.

Physiological Stress: The Silent Killer

Contestants in the game were trembling, sweating, vomiting, bodies strewn with blood and bruises - their bodies buckling under extreme stress. Their disfigured states are the epitome of brutality. Sound exaggerated? It's not far off from reality.

In the real world, chronic financial anxiety causes surges in cortisol and adrenaline. High blood pressure, weakened immunity, increased respiration, heart palpitations, and even heart failure. Millions live this reality every day-not on a remote island, but in our cities, our neighbourhoods, our homes. The person next to you right now may be shattered under the façade of contentment. The stress of unpaid hospital bills, unaffordable prescriptions, and delayed care doesn't just damage credit scores. It kills people. Lives are lost by the second.

Medicating the Pain

Unable to treat the root problem, many turn to temporary relief: drugs. Anti-anxiety meds, sleeping pills, painkillers - legal or illegal. It's all about the money. It's not escape - it's survival. The line between coping and addiction blurs when society offers no better option.

Just like the Squid Game contestants who drank themselves numb before re-entering the death arena, real people rely on pharmaceuticals to silence the panic of living in medical debt. When therapy is a luxury, numbing the pain becomes a necessity.

Suicide: The Unspoken Consequence

When illness is unaffordable and hope is inaccessible, suicide becomes a tragically rational option for some. Medical bankruptcy has become so common it's almost normalised - but its emotional toll remains invisible. Dignity collapses under the weight of unpayable bills. For many, death seems kinder than dying in debt. As viewers of the show, we watch for the blood bath... we would never realise as a society the trauma, difficulties, and emotional toll this game of endurance implements.
The show's fictional players chose to re-enter the game voluntarily. But is it a choice, when survival outside the game is just as lethal?

Healthcare Inequality: A Rigged Game

In Squid Game, players start at different physical and mental levels. So do we. The poor don't just face more sickness; they face fewer options. Preventive care is a privilege for most. But to us, it's like buying over the shelf medication. For them...it's practically trading off their soul. Emergency care becomes the default. The rich see doctors; the poor see debt collectors.

In the real world, a cancer diagnosis doesn't just mean chemotherapy or radiotherapy... it means remortgaging your house. A broken leg might cost you your job. For the uninsured or underinsured, life itself becomes a gamble.

Playing to Stay Alive: When There's No Other Choice

What's most terrifying about Squid Game isn't the games themselves - it's the realism of the players' motivations. Every contestant was cornered. Crushed by loans, medical bills, family pressure, or systemic failure. They didn't want to play. They had no choice. There was no consent. No "let's sit down over coffee and discuss these issues". They were forced into this never-ending pit of foreshadowed death. Because what was there to lose?

Millions today are stuck in similar traps. Rationing insulin, skipping doctor's visits, skimping on medication, halving their pills or working multiple jobs just to cover life insurance. This isn't dystopia. This is Tuesday.

Dehumanisation: The Final Cost

In the game, players are numbered, masked, stripped of names and dignity. You're not a person with dreams, goals, aspirations. You're just a 3 digit number. Player 222. Player 149. Player 456. You're just a numbe

Society does the same. You're not a patient - you're a billing code. Another folder stashed away in a drawer in alphabetised order. You're not a person in pain-you're a liability. Bureaucracy becomes more important than biology. Public health isn't just suffering-it's dehumanising. When survival is contingent on wealth, compassion dies. And when the system sees people as costs, treatment dissolves...

By Olivia MA, Shruthi V & Gurmannat K

The Medical Ethics of Squid Game - Part 2

Set up to Fail: Exploitation of Vulnerability in Squid Game and Real Life

All viewers of the new season of Squid Game understand not all players were given an equal chance. One particularly distressing example is Player 222. From the moment she slipped on the stairs, it was clear she was in serious trouble. Her ankle was swollen, purple, and visibly pulsating, a clear sign of injury. In addition to this, she had recently given birth, making her physically and emotionally vulnerable. Yet, despite the severity of her condition, no medical attention was offered.

This was not only unfair but also medically unethical. In any real-world situation, such an injury would require immediate care. However, within the game, her pain was ignored, and she was expected to continue as though nothing had happened. She was forced to participate in the following round without any form of treatment, placing her at a clear disadvantage compared to the other players. Her suffering was overlooked and treated as irrelevant. The failure to protect her or acknowledge her condition revealed the deeper cruelty of the system. Although the game claimed to offer equal opportunities, players like 222 were clearly set up to fail.

This reflects the reality for many people outside the game. Individuals with medical conditions or postnatal complications often go without proper support, especially when they lack financial security. Like Player 222, they are expected to carry on in systems that do not accommodate their needs. When they fall behind, their struggles are seen as personal shortcomings rather than consequences of systemic neglect. In both the fictional game and in real life, vulnerability is not supported. It is exploited.

Harvested Hope: The Grim Reality Behind Squid Game's Black Market

In the shadows of the game–quite literally, in the hidden corners of the island–underground dungeons dedicated to organ harvesting play a critical role in the series' plot. These operations influence how guards are instructed to kill players: strategically, and in a manner that preserves the organs. Single shots are preferred, specifically in areas that won't compromise the viability of organs. This means some players are left technically alive, continuing to endure the horrors of the game physically and mentally.

These individuals are then placed into "gift boxes" -an ironic packaging choice that implies pleasure or reward, even a twisted sense of gratitude for being selected. Some bodies are incinerated, but others are covertly diverted to undergo this ethically abhorrent procedure.

Players are occasionally recruited into this scheme, such as Player 111, Dr. Yoo Sung-moo–nicknamed the "disgraced doctor." In exchange for extracting organs, he is given inside information about upcoming games. Similarly, in Season 3, another doctor disguised as Guard 016 also participates. These individuals abandon their professional duties as medical practitioners, forsaking medical ethics, patient dignity, and the necessity of informed consent. This shows the desperation that these individuals face and consequently, abandon their moral compass.

Using trained medical professionals for harm underscores the perversion of systems designed to heal. According to the World Health Organisation, more than one illegal organ transaction is made every hour, worldwide. This suggests that organ trafficking is not just fictional horror–it's a real-world crisis. The critical question becomes: Why are they committing such a heinous act? Though the Front Man did not initiate the scheme, he approves of it. Later episodes reveal that his wife died of organ failure–a detail that may subtly explain, though not justify, his complicity.

This subplot reveals that organ trafficking is not an isolated invention of dystopian fiction. Such practices have occurred, as seen in real-world cases like China, where doctors have been jailed for illegal harvesting. Is Squid Game highlighting the notion that humans are ruthless opportunists, preying on the misfortunes of others, and that no system, no matter how tightly controlled, can eliminate all corruption and exploitation?

Death is just a number

In these cooperate games, death is just another gift box - neatly prepared, a name vanishing from the player dashboard, and 100,000,000 ₩ is added to the glorified piggy bank to compensate for a player's misfortune. Death is reduced to a mere number - nothing more. Who cares about the personal struggles of the players, each carrying their burdens, entering the games in search of a new start, a new opportunity, a new life?

To the eyes of the squares, triangles, and circles, the players are merely video game noobs - barely surviving on the bare minimum, lured into believing that a 2.1% chance of survival is enough to spur them toward victory. Naive. But are we not also slaves to our system? The poor grapple with never-ending struggles, desperately clinging to whatever they can to pay medical bills, access proper treatment, or just survive. And in this brutal scramble for survival, countless lives are quietly lost – not in a dramatic burst of gunfire or lethal drops, but through delayed diagnoses, denied care, and untreated pain. These are mass deaths, too – slow, invisible, and systemic – deaths that rarely make headlines but echo through poor communities like a quiet war. It's not a game show, but the stakes are just as fatal.

Now, with Squid Game expected to carry its legacy abroad–to America, the so-called land of freedom–we must asklsis that freedom genuine? If we look closely, is the claim verified? Are they truly self-determining, or just puppets, manipulated by external and internal forces alike? Mass deaths will not remain confined to Korean borders. It's chilling to imagine the scale of this blood-scheme, all disguised as innocent playground games. If this fiction were translated into reality, then surely, we would begin to see people disappear from our lives, one by one.

By Olivia MA, Shruthi V & Gurmannat K

Neuroscience Disorder & Pain

Neuronal plasticity: the brain's amazing ability to adapt

Imagine if the brain could rewire itself, like rearranging your furniture to meet your needs. Well, you don't need to think too hard because our brains do exactly that. This extraordinary ability is called neuronal plasticity or neuroplasticity. It's how we as humans learn, adapt, and recover from injuries.

What is neuroplasticity

As stated in the oxford English dictionary, neuroplasticity is the brain's ability to form or reorganise synaptic connection especially in response to learning or experience or following injury. In short terms it is how the brain creates new/repair neuronal connections. Plasticity can occur at any age, however according to Kendra cherry (a psychosocial rehabilitation specialist), it is most powerful during childhood. This is a great justification as to why young brains can learn languages more quickly or recover from injuries faster. Research does show however that the adult brain remains plastic to a certain degree, in fact recent neuroimaging studies show that the adult brain can develop new neurons in specific regions, for instance the hippocampus (Eriksson et el.,1998).

Types of neuroplasticity

Scientists believe that neuroplasticity can be split into two main categories:

- Functional plasticity: the brain's ability to shift information from one area to another, i.e. After a stroke, other regions of the brain may compensate for lost regions.

- Structural Plasticity: the brain's ability to actually change its physical structure as a result of learning. For example, growth of new dendrites and synapses

Neuroplasticity in mental health

Neuroplasticity plays a critical role in psychiatric disorders such as depression and anxiety.
For instance, Arnsten states that chronic stress has been shown to reduce the prefrontal cortex, the site responsible for decision-making, and it enlarges the amygdala associated with fear and anxiety. The reduction of the cortex means that anxiety not only grows, but it also leads to the reduction of well thought out thoughts leading to the patient making impulsive/inappropriate decisions. In order to mitigate this, they are given antidepressants,

which according to Duman & Monteggia promotes neurogenesis (the creation of new neuronal networks). This ensures that all parts of the brain are connected leading to faster and more effective transport of action potentials.
To conclude neuroplasticity redefines how we think about our brain; it is not just a static organ but something that adapts and reorganises itself according to its experiences and with further research of it we might be able to understand the full capabilities of our brain and unlock its the full potential in medicine, education and beyond.

Bibliography

Cherry.k “How Neuroplasticity Works- Your experiences can change how you brain functions” available at: https://www.verywellmind.com/what-is-brain-plasticity-2794886

Erickson, K.I. et al., 2011. Exercise training increases the size of the hippocampus and improves memory. *PNAS*, 108(7), pp.3017–3022.

Arnsten, A.F.T., 2009. Stress signaling pathways that impair prefrontal cortex structure and function. *Nature Reviews Neuroscience*, 10(6), pp.410–422

Duman, R.S. and Monteggia, L.M., 2006. A neurotrophic model for stress-related mood disorders. *Biological Psychiatry*, 59(12), pp.1116–1127

By Niya S

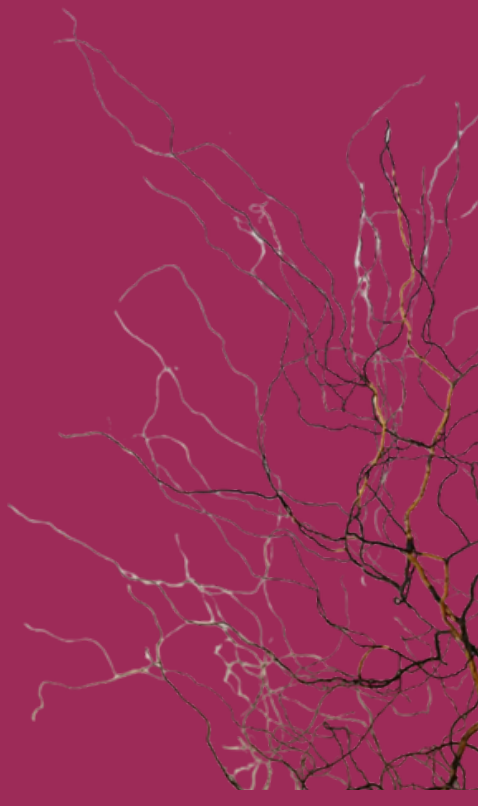
CHARCOT-MARIE-TOOTH DISEASE

What is Charcot-Marie-Tooth disease?

According to the NHS website Charcot-Marie□Tooth (CMT) disease is ‘a group of inherited conditions that damage the peripheral nerves.’ It is a progressive condition, thus symptoms get worse over time so an everyday task which seemed manageable previously can become increasingly difficult. Peripheral nerves are parts of your nervous system which lie beyond the brain and spinal cord (central nervous system) and play key roles in sending information from different areas of your body back to the brain, in addition to transmitting instructions from your brain to different areas of your body. A peripheral nerve consists of an axon, which transmits the electrical signal between your brain and limbs, and the myelin sheath, which wraps around the axon providing insulation. CMT is characterised by muscle weakness (in particular in the feet, ankles, legs and hands) and can be identified by an awkward gait and/or highly arched or very flat feet. It is important to note that whilst symptoms of CMT commonly start to appear between the ages of 5 to 15 years old, it is possible for them not to develop until later in life.

Causes and types of CMT :

CMT is the most common genetic neurological disease in the world, caused by the inheritance of a fault in one of the many genes responsible for the development of the peripheral nerves (this can be inherited from 1 or both parents). Consequently, over time the nerves become damaged.
In some types of CMT, such as CMT 1 (the most common type), defective genes cause the slow degradation of myelin sheath and without this protection the axons become damaged. This affects the efficiency of the transmission of messages between the brain, muscles and senses, manifesting in muscle weakness and numbness. Alternatively, in CMT 2 (a less common and usually less severe type than CMT 1) the axons are directly affected. Therefore, they do not transmit electrical signals at the normal strength. As a result, muscles and senses do not get used enough. Dejerine-Sottas syndrome (DSS) is considered to be a rare and severe type of CMT, set apart from other types by its early onset and more rapid progression- it affects the myelin sheath, leading to significant muscle weakness and sensory loss e.g. decreased sensation, tingling and pain in the limbs. It is common for a child with DSS to experience a delay in motor development, for example when reaching certain developmental milestones such as learning to walk.



This type of CMT can be severely disabling: some patients may never be able to walk, using wheelchairs by the end of their first decade, although some patients may only need a walking stick, cane or similar support throughout their lifetime. Similarly, developing in childhood, CMT 4 is another rare and severe type of CMT affecting the myelin sheath and causes many people to eventually lose the ability to walk. CMT X is a type of CMT which affects more men than women because a man only has one X chromosome and a woman has two. This type of CMT is due to a mutation in the X chromosome and symptoms are less severe - many live a normal lifespan and rarely need a wheelchair

Diagnosis

To get a diagnosis of CMT, the first point of call is to see a general practitioner, who will ask about symptoms and carry out a physical examination. This may include questions on when symptoms started, whether there is a family history of CMT and assessing for muscle weakness, poor or absent reflexes and foot deformities. If CMT is suspected the GP is likely to refer the patient to a neurologist for further testing. During a nerve conduction test, electrodes are placed on a patient's skin which releases small electric shocks to stimulate the nerves and the speed and strength of the nerve signal are measured. An unusually slow or weak signal is an indicator of CMT. Electromyography (EMG) can detect distinctive changes in the pattern of electrical activity caused by some types of CMT. This test involves a small needle-shaped electrode being placed into the patient's skin to measure the electrical activity in their muscles. Moreover, genetic testing can be used, in which a blood sample is taken and tested for defective genes known to cause CMT. Although most people with CMT should be able to have their diagnosis confirmed by this test and find out which type of CMT they have, there are unidentified genes involved in CMT. Thus, for others genetic testing may be inconclusive.

Treatment options

There is no cure for CMT; instead therapies are offered to patients to help reduce their symptoms and provide them with the best quality of life, enabling them to live as independently as possible. Due to the progressive nature of this disease, patients need to be assessed regularly to check for any changes in their condition, which may require altering their treatment plan. Treatment programmes involve many healthcare professionals working together in a multidisciplinary team, with a doctor usually co-ordinating the patient's treatment programme. Physiotherapy is important for reducing the risk of muscle contractures.

In addition to therapies, medication may be prescribed to help control pain. In most cases, non□steroid anti-inflammatory drugs can be used to control joint and muscle pain and neuropathic pain may be treated with tricyclic antidepressants or alternatively an anticonvulsant medication (typically used to prevent seizures). In cases of significant deformities, CMT patients may need surgery to correct them. Arthrodesis involves fusing the 3 main joints in the back of the feet, to strengthen the feet, correct their shape and to relieve pain. After the surgical procedure, the patients foot (or feet) will be put in plaster and they will not be able to place any weight on them for 6 weeks. Consequently, they will be required to use crutches or a wheelchair during this time. It can take up to 10 months for CMT patients to fully recover from this operation. Osteotomy is a surgical procedure used to correct severe flatness of the feet by making an incision in the foot so the surgeon can remove or reposition foot bones into their correct shape. Similarly to arthrodesis, the foot will need to remain in plaster for several weeks until the bones have fully healed.

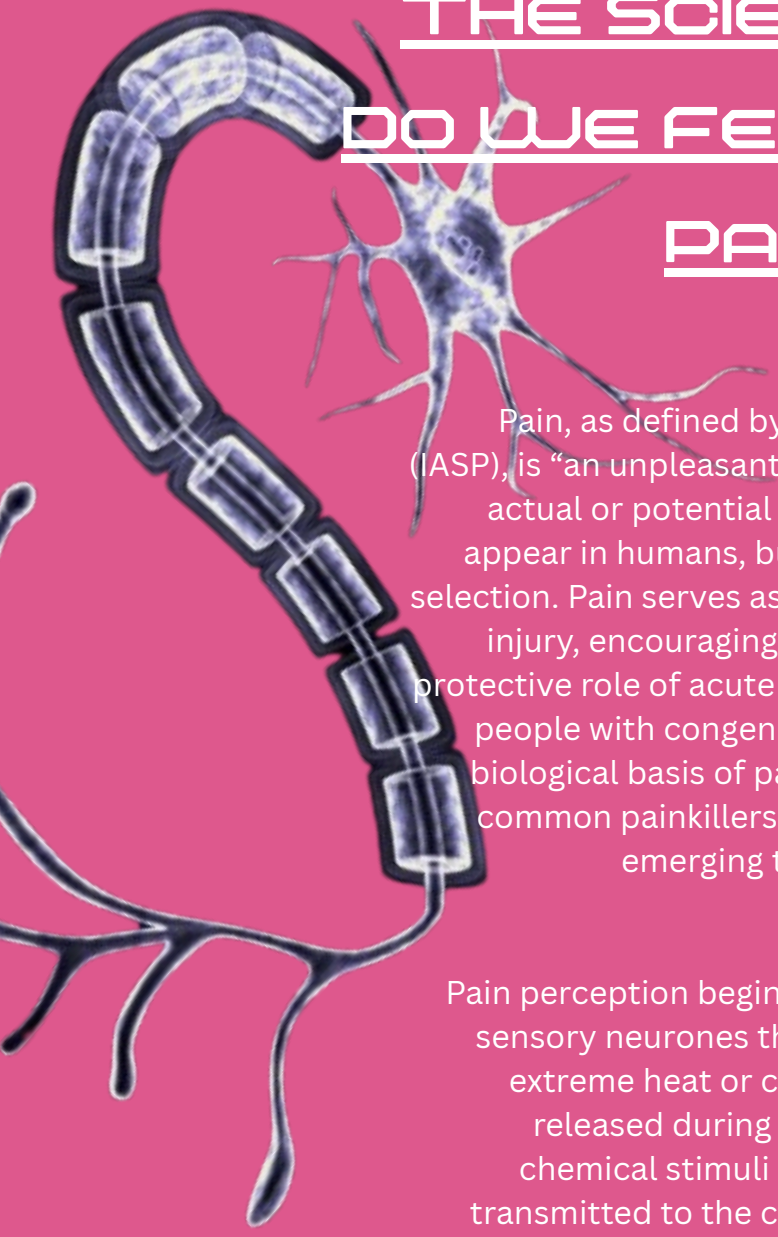
The future

There are several promising research trials investigating the use of stem cells in early stages of CMT development to repair nerve damage. This is in addition to the use of hormones and gene therapy to slow the progression of the condition. However, this research is still in the early stages and is trying to actively recruit individuals with CMT to be involved in clinical trials. The UK CMT research database is open to both adults and children and is largely funded by the charity Charcot-Marie-Tooth UK to promote research into the causes and treatment of CMT and the publication of useful results of such research.

By Natalie R

References

NHS (2025) Charcot-Marie-Tooth disease. Available at: https://www.nhs.uk/conditions/ charcot-maire-tooth-disease/ (Accessed: 10 June 2025). Slides of information about CMT http://www.patedu.com/english/interactive/charcot□marie-tooth-disease/section5_page5 (Accessed: 10 June 2025) Royal College of Podiatry (2020) Charcot□Marie-Tooth disease (CMT) & Podiatry. Available at: https://www.youtube.com/watch?v=fa6ZKLWquul (Accessed: 11 June 2025). BroadcastMed (2025) Foot Surgery—Not Braces—Offers Hope to Patients with Charcot-Marie-Tooth. Available at: https://www.broadcastmed.com/orthopedics/2190/news/foot-surgery-not-braces-offers-hope-to□patients-with-charcot-marie-tooth (Accessed: 11 June 2025). Charcot-Marie-Tooth UK (2025) Home - Charcot□Marie-Tooth UK. Available at: https://www.cmt.org.uk (Accessed: 11 June 2025)



The Science of Pain: Why Do We Feel It, and How Do Painkillers Work?

Introduction

Pain, as defined by the International Association for the Study of Pain (IASP), is “an unpleasant sensory and emotional experience associated with actual or potential tissue damage” (1). This sensation did not suddenly appear in humans, but developed over millions of years through natural selection. Pain serves as a vital survival mechanism by drawing attention to injury, encouraging recovery, and helping to prevent further harm. The protective role of acute pain is demonstrated by the high morbidity seen in people with congenital insensitivity to pain (2). This article explores the biological basis of pain perception, the different types of pain, and how common painkillers provide effective relief, while also looking ahead to emerging treatments that could transform pain management.

What Is Pain? – The Biology of Perception

Pain perception begins at the level of nociceptors: specialised peripheral sensory neurones that respond to potentially damaging stimuli such as extreme heat or cold, intense mechanical force, and chemical signals released during tissue injury. These neurones transduce physical or chemical stimuli into long-distance electrical signals, which are then transmitted to the central nervous system (CNS) to initiate a protective response (3). Two primary types of nerve fibres carry these pain signals:

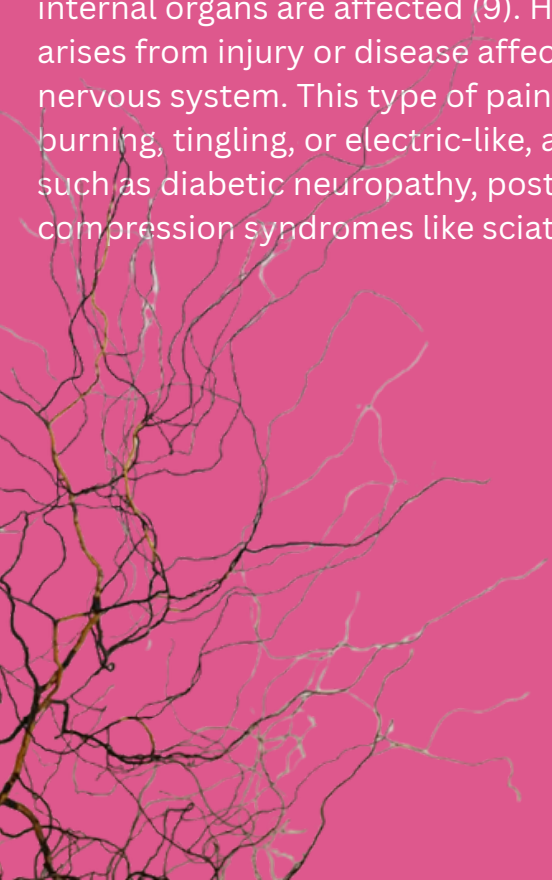
- A-delta (Aδ) fibres, which are thin, myelinated fibres responsible for the rapid transmission of sharp, localised pain
- C fibres, which are unmyelinated and conduct slower, dull, and diffuse pain, as well as temperature sensations (3).

After activation, the signals travel through afferent neurones into the dorsal horn of the spinal cord, where they synapse with secondary neurones. From here, they ascend the spinothalamic tract to the thalamus, which processes and relays the information to various brain regions, including the somatosensory cortex, which interprets the location and intensity of the stimulus (4). Other areas, such as the anterior cingulate cortex and the insular cortex, are involved in processing the emotional and subjective aspects of pain.

Neurotransmitters are chemical messengers that transmit signals across synapses between neurones, and are essential in modulating pain. Glutamate and substance P (SP) are the main neurotransmitters associated with this sensation. Glutamate is involved in the rapid neurotransmission of acute pain by acting on receptors located on Aδ fibres. In contrast, SP transmits pain by secretion from nerves and inflammatory cells, and acts by binding to neurokinin-1 (NKR1) receptors that are located on the nociceptive neurones on C fibers (5).#

Types of Pain

Pain can be categorised in two main ways: by its duration (acute or chronic) and by its underlying mechanism (nociceptive or neuropathic). Recognising both the type and duration of pain is essential for guiding effective treatment. Acute pain is short-term, lasting from a few minutes to as long as six months. It is often linked to soft-tissue injuries or temporary illnesses and usually resolves after the injury heals or the illness subsides. However, if the injury does not heal correctly, acute pain can progress into chronic pain. Chronic pain is longer in duration and can be intermittent or constant. It is often due to a health condition, like arthritis, fibromyalgia, or spinal disorders (6). Beyond its physical burden, chronic pain can lead to serious complications and overall quality of life is diminished. For instance, patients can experience allodynia, where non-painful stimuli cause pain. Sleep disturbances and depression are also common: it is estimated that 48% of people with chronic pain also suffer from depression (7). Over time, chronic pain can induce structural and functional changes in the brain, a process known as neuroplasticity, which can reinforce pain perception and make it more difficult to treat (8). When considering mechanisms, pain can also be classified as nociceptive or neuropathic. Nociceptive pain results from the activation of nociceptors. It may be: ● Somatic: the specific location of the pain can be identified. It can be felt in the skin, muscles, bones or connective tissue. ● Visceral: the specific location of the pain cannot be identified as the internal organs are affected (9). However, neuropathic pain arises from injury or disease affecting the somatosensory nervous system. This type of pain is often described as burning, tingling, or electric-like, and can occur in conditions such as diabetic neuropathy, post-herpetic neuralgia, or nerve compression syndromes like sciatica (10).



How Do Painkillers Work?

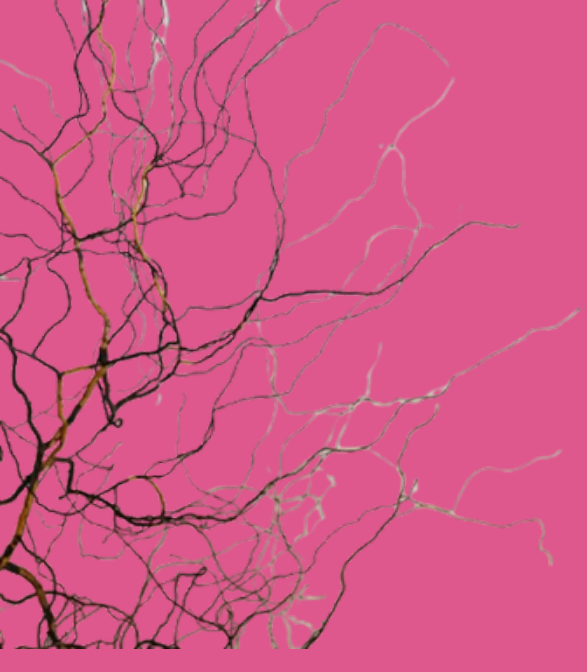
Paracetamol (Acetaminophen) Paracetamol is one of the most commonly used painkillers for mild to moderate pain and fever. Unlike NSAIDs, it is not strongly anti-inflammatory. Its exact mechanism is still not fully understood, but it is thought to weakly inhibit the cyclooxygenase (COX) enzyme, particularly in the brain (11). COX is responsible for converting arachidonic acid into prostaglandins - chemicals that contribute to pain and fever - in this reaction: 1. Arachidonic acid binds to the COX active site. 2. COX converts it into prostaglandins. 3. These prostaglandins then act on nerve endings to produce pain and raise body temperature. By partially blocking this process in the CNS, paracetamol helps reduce pain and fever. However, an overdose can overwhelm the liver's ability to process it, leading to liver injury (12)

NSAIDs

(Non-Steroidal Anti-Inflammatory Drugs) NSAIDs, such as ibuprofen and aspirin, are commonly used to treat inflammatory pain, such as arthritis. They also inhibit COX enzymes, but with a stronger anti-inflammatory effect than paracetamol. There are two main COX enzymes: ● COX-1 is found in most tissues and produces prostaglandins that protect the stomach lining and support blood clotting. ● COX-2 is produced in response to inflammation and generates prostaglandins that cause pain and swelling. The anti-inflammatory effects of NSAIDs mainly come from COX-2 inhibition, while side effects like ulcers and bleeding result from COX-1 inhibition. In aspirin, the mechanism involves a chemical reaction: 1. Aspirin undergoes hydrolysis, releasing an acetyl group. 2. This acetyl group binds to an -OH group in COX's active site (acetylation). 3. Acetylation makes the COX cavity smaller, blocking arachidonic acid entry. 4. As a result, no prostaglandin is formed, and pain is relieved (13).

Opioids

Opioids, such as morphine and codeine, are powerful painkillers used to treat severe acute pain, like after surgery or serious injury. Unlike paracetamol and NSAIDs, which act on enzymes involved in inflammation, opioids work by binding to mu-opioid receptors in the brain and spinal cord. This binding blocks the transmission of pain signals within the CNS, reducing the brain's perception of pain. While highly effective, opioids carry significant risks. These include: tolerance (needing higher doses over time), opioid-use disorder and immune suppression (14).



Chronic Pain Mechanisms & Management

Chronic pain is often driven by central sensitisation: an increased responsiveness of nociceptors in the CNS to either normal or sub-threshold afferent input. This results in hyperalgesia (hypersensitivity to pain), allodynia, and an increased pain response evoked by stimuli outside the area of injury. A key factor in this process is the activation of NMDA receptors, which play a role in amplifying and maintaining pain signals (15). Treatment options for chronic pain include: ● Medications: Antidepressants (e.g. amitriptyline) and anticonvulsants (e.g. gabapentin) are commonly used to modulate neurone activity in chronic pain. ● Psychological Therapy: Cognitive Behavioural Therapy (CBT) helps patients manage the psychological impact of chronic pain, as part of a multidisciplinary pain management programme (16). ● WHO Pain Ladder: Originally designed for cancer pain, the WHO pain ladder provides a stepwise approach to pain management, starting with non-opioids, escalating to weak opioids for moderate pain, and strong opioids for severe pain (17).

The Future of Pain Relief

Conventional therapeutic agents including opioid and non-opioid analgesics have been associated with adverse side effects and issues with addiction, hence innovation in chronic pain treatment has shifted toward non-addictive approaches: ● Virtual reality (VR) offers relief through distraction, mindfulness, and neural reprocessing. The distraction element of VR functions by treating pain via reduction of the subjective sensation of pain by redirecting the user's attention away from the pain. In chronic low back pain, VR has shown analgesic effects comparable to opioids, without their side effects. Augmented reality (AR) enhances remote care, offering high-quality telehealth experiences for patients unable to attend in-person appointments. ● Wearable medical technology, such as smartwatches with integrated health apps, tracks surrogate pain indicators like heart rate variability. By closely monitoring these measures, clinicians may uncover new data linked to pain patterns. Beyond data collection, wearables provide secondary benefits: patients have shown a significant decrease in depression and reduced opioid use. ● Neuromodulation involves regulating nerve activity by delivering electrical or pharmaceutical agents directly to target areas. By integrating AI into neuromodulation, data collection and monitoring phases of neuromodulation can be enhanced, allowing for opportunities to significantly improve outcomes for chronic pain patients. Setting the neuromodulation device on autopilot may allow the device to adapt to the patient's pain and potentially predict pain (17

Conclusion

To conclude, pain is a multifaceted and essential biological process that plays a critical role in survival and healing. Appreciating the distinction between acute and chronic pain is crucial, as they differ significantly in both mechanisms and the treatments they require. Painkillers target various biological pathways, ranging from enzyme inhibition to receptor binding, highlighting the complexity of pain modulation. As our understanding of pain deepens, so does our ability to innovate. Future therapies are moving towards safer, more individualised, and holistic solutions that not only alleviate pain but also improve patients' overall quality of life

Reference List

1. Raja SN, Carr DB, Cohen M, Finnerup NB, Flor H, Gibson S, et al. The revised International Association for the Study of Pain definition of pain: concepts, challenges, and compromises. Pain [Internet]. 2020 Aug 5;161(9). Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC7680716/ 2. Walters ET, De C Williams AC. Evolution of mechanisms and behaviour important for pain. Philosophical Transactions of the Royal Society B Biological Sciences [Internet]. 2019 Sep 23;374(1785):20190275. Available from: https://doi.org/10.1098/rstb.2019.0275 3. Dubin AE, Patapoutian A. Nociceptors: the sensors of the pain pathway. Journal of Clinical Investigation [Internet]. 2010 Nov 1;120(11):3760–72. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC2964977/ 4. Osterweis M, Kleinman A, Mechanic D. The anatomy and physiology of pain [Internet]. Pain and Disability - NCBI Bookshelf. 1987. Available from: https://www.ncbi.nlm.nih.gov/books/NBK219252/ 5. Gatchel R, Ray C, Spights K, Garner T, Beggs E, Hulla R, et al. The neuroscience of pain. MedCentral [Internet]. 2016 Jun 16; Available from: https://www.medcentral.com/pain/chronic/neuroscience-pain. [Accessed 23 Jun 2025] 6. The five types of Pain | McLaren Health Care News [Internet]. 2023. Available from: https://www.mclaren.org/main/news/the-five-types-of-pain-4386. [Accessed 15 May 2025] 7. Chronic pain: What are the complications? NICE [Internet]. Available from: https://cks.nice.org.uk/topics/chronic-pain/background-information/complicatio ns/. [Accessed 15 May 2025] 8. Yang S, Chang MC. Chronic pain: structural and functional changes in brain structures and associated negative affective states. International Journal of Molecular Sciences [Internet]. 2019 Jun 26;20(13):3130. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC6650904/ 9. Nociceptive pain. Cleveland Clinic [Internet]. Available from: https://my.clevelandclinic.org/health/symptoms/nociceptive-pain. [Accessed 24 Jun 2025] 10.Pain types. PainHEALTH [Internet]. 2023. Available from: https://painhealth.csse.uwa.edu.au/pain-module/pain-types/. [Accessed 24 Jun 2025] 11. Graham GG, Scott KF. Mechanism of action of paracetamol. American Journal of Therapeutics [Internet]. 2005 Jan 1;12(1):46–55. Available from: https://pubmed.ncbi.nlm.nih.gov/15662292/ 12.McCrae JC, Morrison EE, MacIntyre IM, Dear JW, Webb DJ. Long-term adverse effects of paracetamol – a review. British Journal of Clinical Pharmacology [Internet]. 2018 Jun 4;84(10):2218–30. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC6138494/ 13.NSAIDs - prescribing issues: Mode of action. NICE [Internet]. Available from: https://cks.nice.org.uk/topics/nsaids-prescribing-issues/background-informatio n/mode-of-action/. [Accessed 16 May 2025]

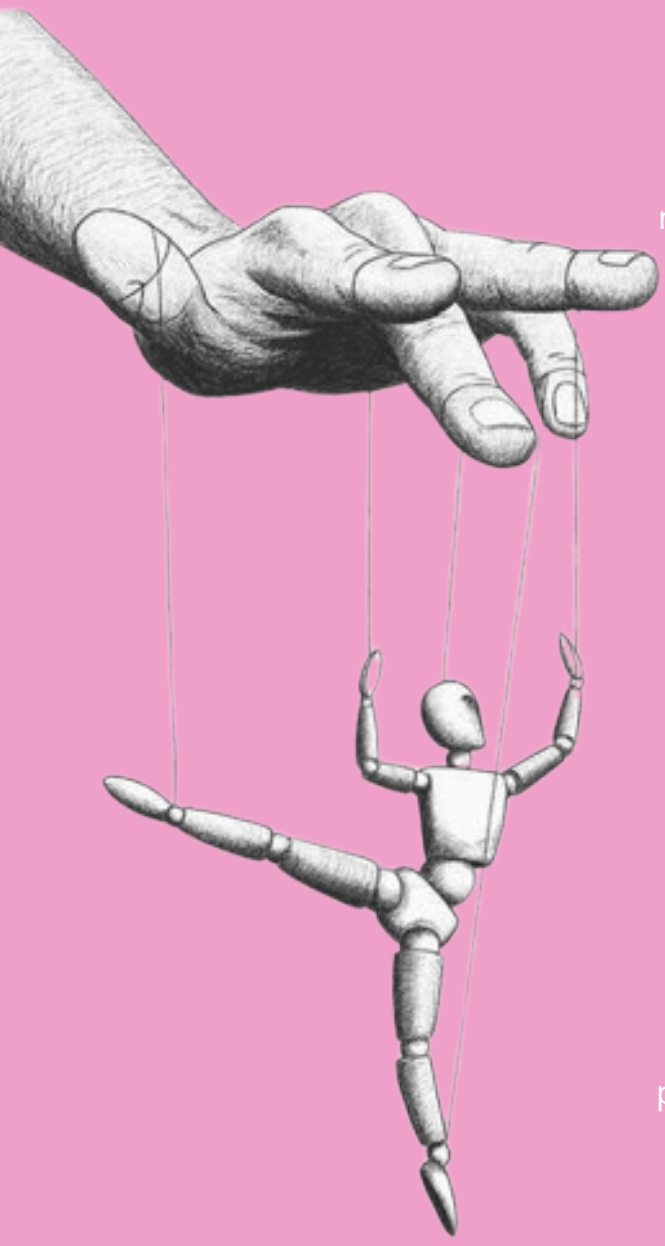
14.Lambert DG. Opioids and opioid receptors; understanding pharmacological mechanisms as a key to therapeutic advances and mitigation of the misuse crisis. BJA Open [Internet]. 2023 May 17;6:100141. Available from: https://www.sciencedirect.com/science/article/pii/S2772609623000205 15.Raja SN, Sivanesan E, Guan Y. Central sensitization, N-methyl-D-aspartate receptors, and human experimental pain models. Anesthesiology [Internet]. 2019 Jun 25;131(2):233–5. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC6640094/ 16.Chronic pain [Internet]. Cleveland Clinic. 2025. Available from: https://my.clevelandclinic.org/health/diseases/4798-chronic-pain. [Accessed 17 May 2025] 17.Slitzky M, Yong RJ, Lo Bianco G, Emerick T, Schatman ME, Robinson CL. The future of pain Medicine: emerging technologies, treatments, and education. Journal of Pain Research [Internet]. 2024 Aug 1;Volume 17:2833–6. Available from: https://pmc.ncbi.nlm.nih.gov/articles/PMC11370752

By Rianna S

The Teenage Brain: Wired for Chaos or Creativity?

Intro

Adolescence is widely recognised as a period of rapid psychological and neurological development. Often associated with impulsivity, mood swings, and risk-taking behaviours, the teenage years are frequently misunderstood as a time of emotional chaos. However, current research in developmental neuroscience suggests a more nuanced view: that the adolescent brain is not dysfunctional but undergoing a critical and highly adaptive phase of growth that fosters both learning and creativity. "Adolescence is a period of life in which the brain is particularly adaptable and responsive to the environment" (Blakemore, 2018).



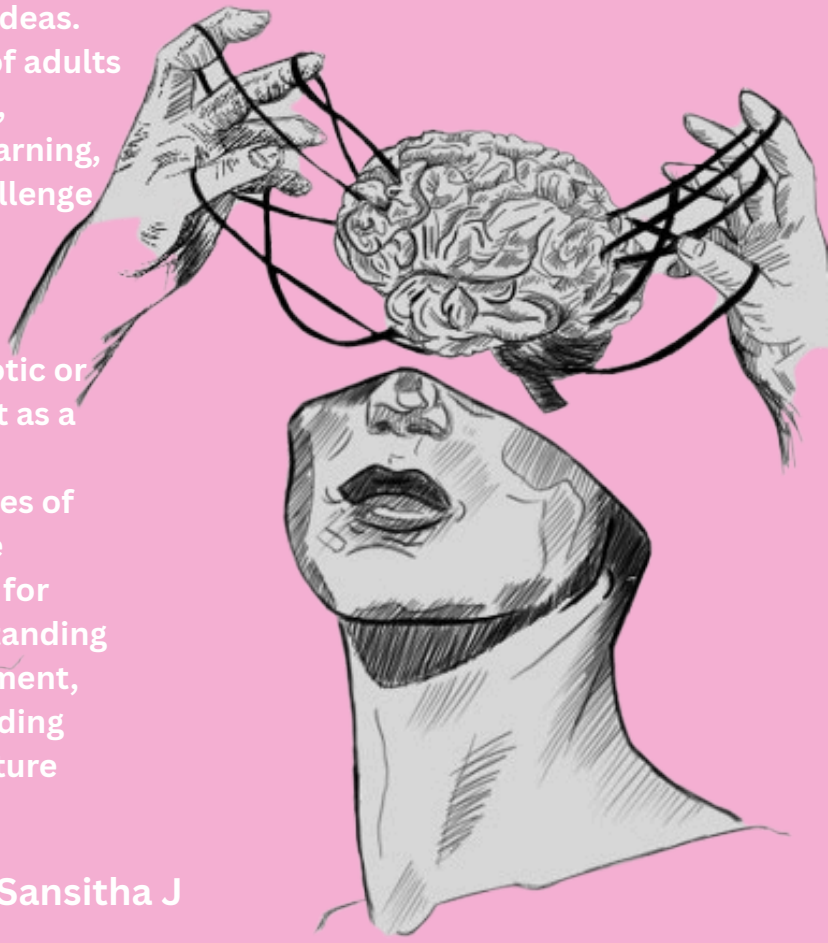
Neural Restructuring During Adolescence

One of the most significant changes occurring in the teenage brain is synaptic pruning. During early childhood, the brain forms an abundance of neural connections. As teenagers grow, the brain begins to eliminate weaker or unused synapses to strengthen more frequently used pathways. This process increases neural efficiency, particularly in regions involved in higher cognitive functions such as reasoning, judgement, and self-regulation. (Giedd, 2004).

At the same time, myelination (the formation of a fatty insulating layer around neurons) increases the speed and coordination of neural signalling, these changes occur unevenly across the brain. While the limbic system (associated with emotion, motivation, and reward) matures early, the prefrontal cortex (responsible for executive functions like planning, impulse control, and risk assessment) develops much later, often continuing into your mid-twenties (Casey, Jones and Hare, 2008). This developmental imbalance can result in emotionally driven decision-making and heightened sensitivity to social and emotional stimuli. However, it also enables heightened creativity and openness to experience. "Adolescence is a period of increased creativity, curiosity, and exploration," which plays a crucial role in identity formation and innovation (Blakemore and Mills,2014) .

Risk-Taking as a Developmental Strategy

It is established that teenagers are more likely to engage in risk-taking behaviour, but this is not indicative of poor judgement. From an evolutionary perspective, moderate risk-taking is advantageous, encouraging individuals to explore new environments, establish independence, and form peer connections (Steinberg, 2007). Neuroscientific research using fMRI has shown that adolescents exhibit heightened activity in the ventral striatum, a region of the brain strongly associated with dopaminergic reward pathways. This suggests that the teenage brain is particularly sensitive to rewards, especially in situations involving uncertainty. “The adolescent brain appears to be particularly sensitive to reward, especially when outcomes are unpredictable”, (Galván 2010) This heightened neurological responsiveness to both reward and novelty helps explain why teenagers are naturally drawn to experimentation- behaviours which, although sometimes risky, are also strongly connected to creativity, exploration, and divergent thinking. Many scientific breakthroughs, artistic achievements, and entrepreneurial ventures have originated from young minds, who are willing to challenge norms and pursue unconventional ideas. “Adolescents combine the physical strength of adults with the plasticity of children” (Gopnik, 2016), meaning adolescent brains allows for rapid learning, making teenagers suited to adapt quickly, challenge norms and generate cultural ideas.



Conclusion

Rather than viewing the teenage brain as chaotic or incomplete, it is more accurate, to recognise it as a dynamic, developing system optimised for adaptation. The neurodevelopmental processes of adolescence can at times leading to impulsive behaviour, however, also lays the groundwork for creativity, and intellectual growth. By understanding the science behind adolescent brain development, adults can better support young people, by aiding them to manage their challenges but also nurture their capacity for innovation.

By Sansitha J

Public Health, the NHS & Access to Care

Multidisciplinary Teams & the NHS's Tiered Care System

A multidisciplinary team is a group of staff from different professions and areas of healthcare working together to provide holistic, patient-centred care. MDT meetings are typically held once a week, where everyone involved in the patient's care come together to discuss a treatment plan moving forwards. In order to evaluate said plan holistically in accordance with the patient's wishes, a diverse team of specialists' input is necessary. Consequently, MDTs are comprised of many allied healthcare professionals and other civil workers, highlighting the importance of integration within the NHS to address the medical, emotional and social needs of patients comprehensively.

There are numerous members in an MDT, separated into three main categories: primary, secondary, and tertiary care.

Primary Care

Primary care mostly consists of GPs (general practitioners), who act as the first point of contact to healthcare. They play a crucial role in the general public's accessibility to treatment, as well as early detection of illnesses to avoid escalation. GPs form the backbone of preventative care by offering vaccination programs and screenings to communities, resulting in the reduction of more harmful problems in the future which might call for specialist intervention. When a primary physician finds a condition requiring further investigation or treatment, the patient is referred to the secondary tier of healthcare.

Other roles in primary care include pharmacists, optometrists, dentists, etc. which offer services directly to communities without the need for referrals. More recently, the NHS 10-year health plan has discussed bringing on more professionals such as physiotherapists, mental health practitioners and social workers into the primary care MDTs in order to reduce the strain on GPs and allow experts more qualified in fields such as mental health or chronic illnesses to provide care for patients.

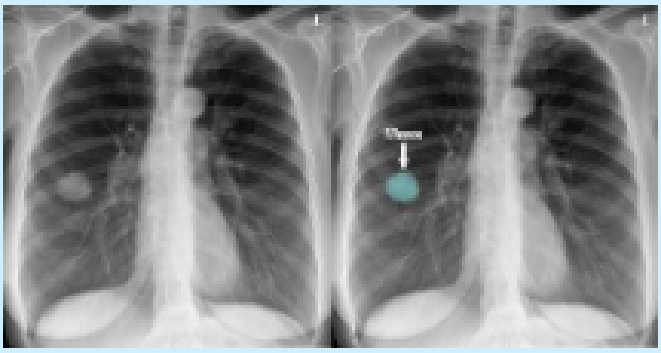
Secondary Care

Secondary care alludes to specialised treatment requiring referrals from a GP, typically conducted in hospitals. The clinical management of a patient's ongoing care is mainly led by professionals in secondary care, with GPs taking a minor role as the patient's advocate to ensure ongoing support is provided when they no longer need specialist services.

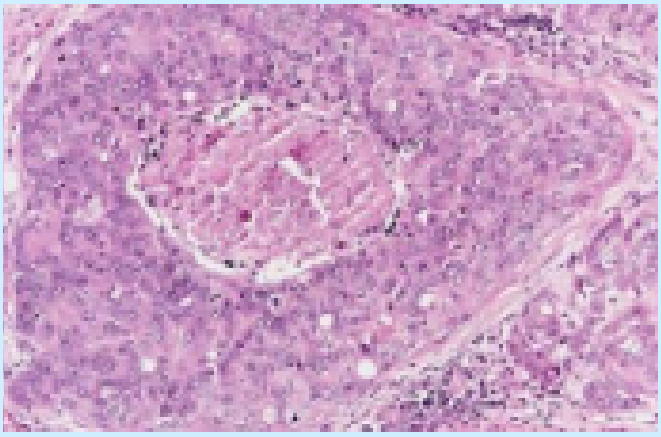
Multidisciplinary Teams & the NHS's Tiered Care System

If a patient is diagnosed with cancer, for example, a multidisciplinary team is assembled with the following members:

- Consultant physician: who the patient is initially referred to by their GP- if they experience gynaecological problems, for example, they are referred to a gynaecologist. The consultant then diagnoses cancer and leads further treatment plans.
- Clinical oncologist: specialised in cancer treatment- confirms stage of cancer and discusses management of symptoms, treatment options (chemotherapy, radiotherapy, etc.) and side effects.
- Cancer nurse specialist: key worker providing support for patient, acting as main contact to ensure involvement in the decision-making process with expert knowledge and experience with cancer.
- Histopathologist: examines tissue samples in detail to diagnose/monitor effectiveness of treatment in combating cancer growth.
- Radiologist: interprets results of imaging techniques to determine diagnosis and help to find the most appropriate plan.

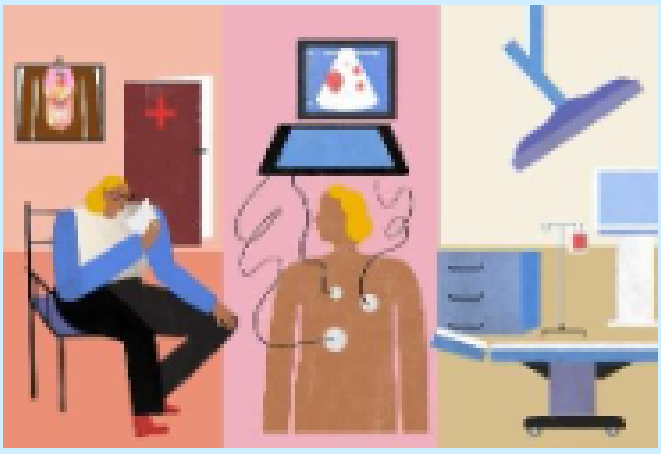


There are a range of allied health professionals that also form an integral part of the MDT, helping the patient with their everyday activities, such as dieticians, speech & language therapists, occupational therapists and more if required.



Tertiary Care

When community clinics and general hospitals cannot offer the required procedures, they refer the patient to tertiary care centres, which are often large, specialised university hospitals. They offer major procedures requiring complex equipment and expertise, such as surgeries to remove benign tumours (in cases of cancer) or organ transplants.



By Nethra VK

Modern Health Issues

Modern health issues come in a wide range of forms, from mental health crises to physical ailments caused by lifestyle or climate changes. Modern technology, new lifestyles and global events are all examples of factors that impact both physical and mental health. Below is a more detailed look at them:

Physical Health

Office-based, financial or transportation jobs are all types of sedentary jobs, meaning that they primarily involve sitting for prolonged periods of time, and doing little physical activity. As the number of sedentary jobs have greatly increased over time, so have the rates of some health issues such as obesity, metabolic disorders and even type 2 diabetes. Solutions include encouraging movement in daily routines, and the rise of home-based fitness solutions.

Mental Health

As well as physical health, mental health is also impacted by modern technology. Since the introduction of social media and prevalence of electronic devices at homes, people (especially younger generations and teenagers, like the students attending this school) experience a lot more stress, peer pressure, social anxiety and even depression. This may be due to cyberbullying or social media addiction.

Environmental Change

Climate change and global warming is also a recent and major factor that exacerbates and causing some more health issues. This includes heat related illnesses and disruptions to food and water security, in extreme cases. As well as that, in some places the air quality has decreased massively, due to pollution, contributing to respiratory illnesses, cardiovascular diseases, and other health problems.

Conclusion

As they say, modern problems require modern solutions; the first step to solving for modern health issues is spreading awareness. The health issues summarised above are quite prevalent, and we need to have adequate facilities and infrastructure to address them. The good news is that they are each addressable, whether we speak about prevention or cure. So, let's always follow the maxim – healthy living, is happy living!

By Ishita G

A new endometriosis pill on the NHS could benefit more than 1,000 women a year – what is it and how can it help?

What is endometriosis?

Endometriosis is a long-term condition where tissue similar to the lining of the womb grows in other parts of the body, often around the ovaries, fallopian tubes, and pelvic lining, but it can also affect the bladder, bowel, and, more areas outside the pelvis. This tissue behaves like womb lining – breaking down and bleeding during the menstrual cycle – but unlike a normal period, the blood has no way to exit the body, causing inflammation and pain.

Common symptoms include severe period pain, heavy bleeding, pain during bowel movements or urination, and chronic fatigue. Endometriosis affects around 1.5 million women in the UK and can significantly impact quality of life, though various treatments are available to help manage the condition.

What is the new endometriosis pill and how does it work?

A new once-daily pill, linzagolix, has been approved for use on the NHS to help manage the symptoms of endometriosis, offering hope to over a thousand women in England each year. Approved by the National Institute for Health and Care Excellence (NICE), linzagolix will be available to patients who have not had success with previous medical or surgical treatments.

The medication works by reducing painful periods and non-menstrual pelvic pain and will be prescribed alongside low-dose hormone replacement therapy (HRT), known as 'add-back' therapy, to help prevent menopause-like side effects and bone loss. It is expected to be made available to NHS patients across England in the coming months. It has been successful in clinical trials as linzagolix was shown to reduce painful periods and non-menstrual pelvic pain, compared with placebo.

Previous treatments for endometriosis

Until recently, treatment options for endometriosis have focused on managing symptoms rather than offering a cure, as the exact cause of the condition remains unknown. Pain relief is often the first line of treatment, typically involving over-the-counter painkillers like paracetamol and ibuprofen. Hormonal treatments, such as the combined contraceptive pill, can also help by reducing or stopping periods, thereby easing symptoms.

In more severe cases, where pain is debilitating or fertility is affected, surgery may be recommended to remove endometrial tissue, ovarian cysts, or even parts of affected organs such as the womb, ovaries, bladder, or bowel. However, symptoms can return after surgery, and some patients may require multiple procedures due to recurring pain or complications like adhesions.

The recent approval of linzagolix follows relugolix combination therapy, the first long-term take-home pill for endometriosis approved for NHS use in March, marking a

A new endometriosis pill on the NHS could benefit more than 1,000 women a year – what is it and how can it help?

significant advancement in non-surgical treatment options.

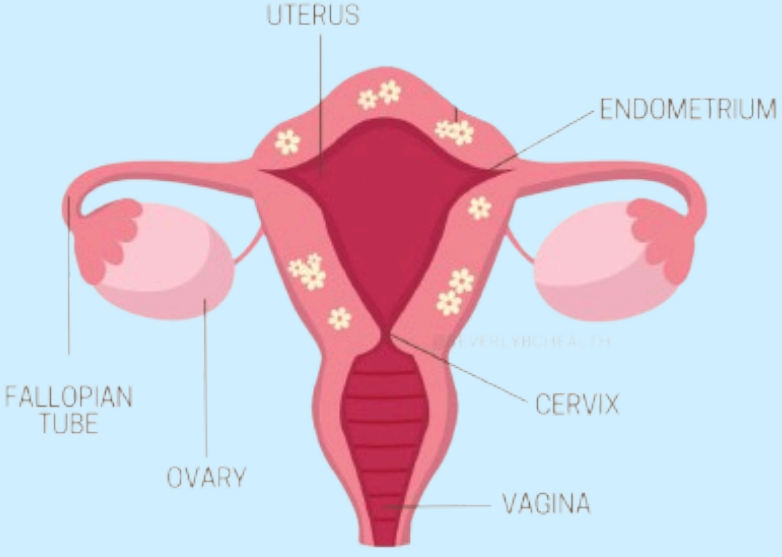
Support available for those living with the disease

Support for those living with endometriosis extends beyond medical treatment, with services available to help manage the wider impact of the condition. This includes advice on coping with chronic pain and fatigue, mental health support for those experiencing anxiety or low mood, and referrals to fertility specialists for women struggling to conceive.

The approval of linzagolix has been welcomed by healthcare professionals and government leaders alike. Dr Sue Mann, National Clinical Director in Women's Health for NHS England, praised the new treatment as an important option for women who haven't responded to previous therapies or surgery, highlighting its potential to improve quality of life and empower women to manage their symptoms at home. This was emphasised in her statement: "This is a testament to our ongoing commitment to improving treatment, care and quality of life for women – and follows the approval just months ago of the first long-term daily pill for managing endometriosis on the NHS, giving women more choice in treatment they can take in the comfort of their own homes."

Women's Health Minister Baroness Merron called it a "game-changer" and emphasized the government's commitment to improving women's health, through faster diagnosis, better treatment, and increased support, as part of a broader effort to end years of underinvestment in this area, adding that "After years of neglect in women's health, we are turning the tide – backing new treatments like linzagolix, cutting diagnosis times and slashing waiting lists. Through our Plan for Change, we will make sure the NHS is there for all women when they need it."

The approval of the new endometriosis pill, linzagolix, marks a significant step forward in the treatment and care of women living with this often debilitating condition in England. As only the second take-home medication of its kind, it offers new hope to those who have struggled to find relief through existing treatments or surgery. By providing a more convenient, non-invasive option for managing pain and other symptoms, linzagolix empowers women to take greater control over their health and wellbeing. Its introduction also reflects a broader shift in prioritising women's health, with growing recognition of the need for better care, faster diagnosis, and more support for those affected by endometriosis.



By Sachee K

The Economics of the NHS

Born out of post-war reforms in 1948 as part of a vision for universal, free healthcare - the NHS is one of Britain's proudest achievements. Yet, as costs soar and budgets tighten, understanding its economics is more important than ever.

In 2024-2025, the NHS is set to receive approximately £165 billion in government funding. At first glance, this seems like a substantial amount. But as a share of GDP, the UK spends only 10% on healthcare – less than Germany (12.5%), France (12.1%), and significantly less than the USA (17%), despite having an ageing population and rising levels of chronic illness.

The NHS is the single largest part of government spending, supporting 1.3 million staff, over 1 million GP appointments daily, and tens of thousands of hospital treatments every day. Demand has been rising rapidly. Yet, during much of the 2010s, annual NHS funding increases averaged just 1% per year – the lowest since its creation. Had investment kept pace with historical trends, NHS funding today might be £30-40 billion higher.

Healthcare is what economists call a merit good: it benefits both individuals and society, but if left entirely to the free market, it is likely be under-consumed. This is due to negative externalities of consumption, where the failure of restrictive access or lacking affordability of healthcare doesn't just harm an individual, but tends to impose wider costs on society – such as increased spread of infectious diseases or higher future treatment costs in cases of conditions that worsen without early care. For example, if someone skips vaccinations or regular check-ups due to high costs, it can lead to outbreaks or expensive emergency care that affect everyone, not just the individual. That's why the UK provides healthcare free at the point of use: to ensure wider social benefits are realised and prevent these negative spillover effects.

But a limited budget and rising demand – from an ageing population, lifestyle-related illnesses, and expensive new treatments – mean the NHS faces unavoidable trade-offs.

The unavoidable, real-life trade-offs the NHS faces interlinks with the economic theory of opportunity cost: e.g., every pound spent on cancer treatment is a pound not spent on mental health or A&E. Economists use tools like cost-effectiveness analysis, often based on QALYs (Quality-Adjusted Life Years), to guide these decisions. For example, a cancer drug that extends life by six months at £100,000 might offer fewer QALYs per pound than a mental health program that helps hundreds at a fraction of the cost. But there's no perfect formula that balances fairness, urgency, and impact.

Beyond scarcity, health economics also studies incentives and inefficiency. If hospitals are paid per patient seen, does that encourage quantity over quality? Should GPs be rewarded for preventing illness, not just treating it? Even small design choices in funding and incentives can have massive effects when scaled across millions of patients.

Grasping the economics behind the NHS should emphasise to aspiring medics that delivering care isn't just about treatments and diagnoses, but rather the fine act of balancing ethics, fairness, and limited resources all at once to do the greatest good for patients. For tomorrow's doctors, understanding these challenges is essential to advocate effectively, make fair decisions, and provide the best care in a system where every choice can change lives.

By Sneha S

Beyond The Hype: is veganism really as healthy as it seems?

Introduction

The vegan diet has recently gained immense popularity for its ethical, environmental and health benefits, however, is it truly as beneficial as it seems or simply an overhyped trend? This article discusses the risks and benefits of a wholly vegan lifestyle.

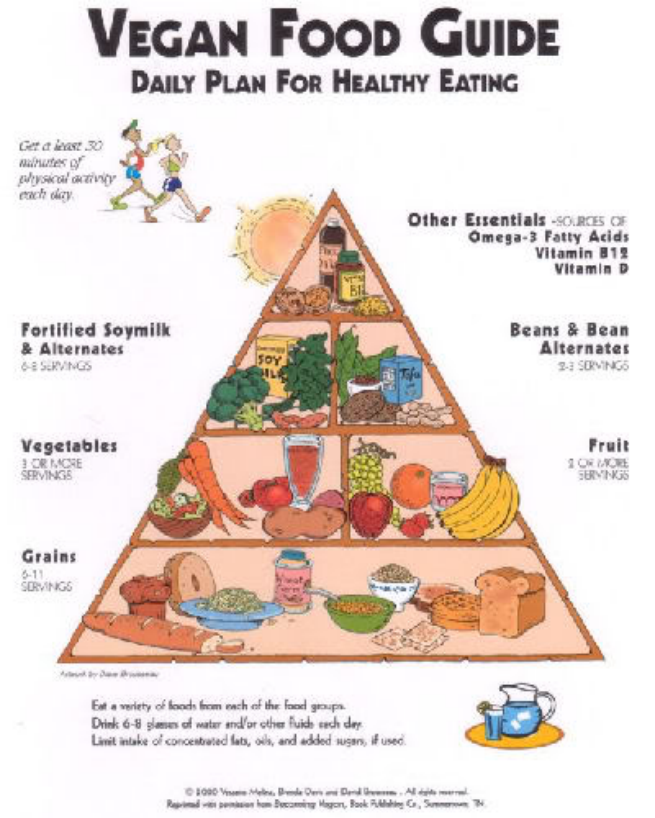
Nutrient Deficiencies

Some of the most prevalent dangers are nutrient deficiencies. For example, Vitamin B12 plays a crucial role in nerve function, red blood cell production and energy levels. Found primarily in animal products, a deficiency could lead not only to anaemia and fatigue but also irreversible nerve damage. This could be fatal since nerves allow communication between the brain and the body, enabling everything from conscious movement and thought to unconscious bodily functions such as breathing and heart regulation. Without B12, this whole vast network would struggle to function causing cognitive impairments such as memory loss and confusion. For pregnant women, the absence of B12 could lead to several foetal neural tube defects such as Anencephaly: a condition where the brain and skull don't fully develop, often leading to stillbirth or death shortly after birth. Omega 3 fatty acids are also essential for brain and heart health; these are usually found in fish such as salmon mackerel and tuna – not only do they have anti-inflammatory properties but also prevent heart disease and lower blood pressure. Lacking these can lead to increased joint pain/discomfort, potentially worsening conditions like arthritis and cause an increased risk of heart disease, including heart attack and stroke.

Effects on Health

Furthermore, these key nutrients also contribute to hormonal and mental health by playing critical roles in brain chemistry. As mentioned, Vitamin B12, found almost exclusively in animal products, is essential for neurological health and the synthesis of mood-regulating neurotransmitters like serotonin and dopamine; its deficiency has been linked to depression, fatigue, and cognitive decline. Similarly, omega-3 fatty acids – particularly DHA and EPA – are vital for brain structure and function, and low levels may impair emotional regulation and increase the risk of anxiety and mood disorders. In addition, iron and zinc, both of

Beyond The Hype: is veganism really as healthy as it seems?



which are more commonly found in animal sources, are crucial for maintaining energy levels, concentration, and hormonal balance; an inadequate intake can lead to irritability, brain fog, and weakened immune response. On the other hand, Overconsumption of soy-based products, which contain phytoestrogens, may disrupt oestrogen levels in sensitive individuals, potentially affecting reproductive hormones and mood stability. Additionally, insufficient intake of amino acids from diverse protein sources can hinder neurotransmitter production, causing symptoms of depression or anxiety. Some studies suggest that vegans may experience higher rates of psychological distress compared to omnivores, though findings are mixed and often depend on diet quality and individual nutrient status.

Conclusion

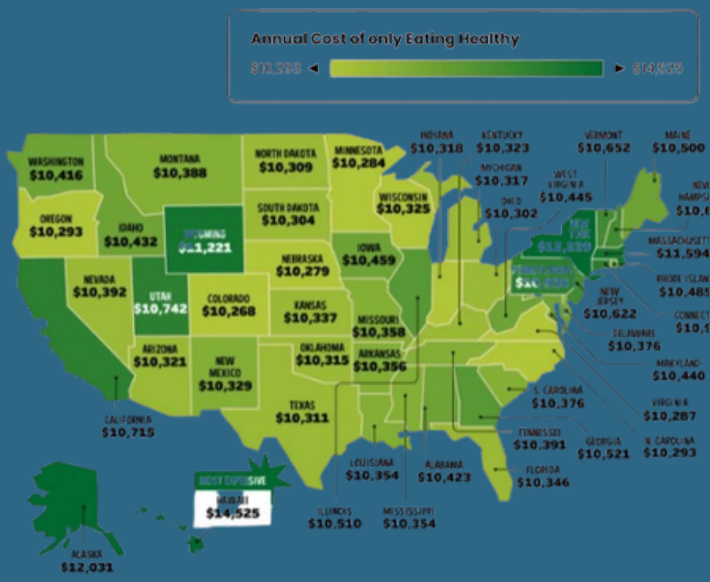
To conclude, while a vegan diet can offer numerous health benefits, it also carries potential risks to hormonal and mental health – particularly when key nutrients are neglected. The most effective way to mitigate these risks is through strategic planning and consistent monitoring. Vegans should prioritize consuming fortified foods and consider supplements for nutrients like vitamin B12, omega-3 fatty acids (DHA and EPA), vitamin D, iron, and zinc. Including a wide variety of plant proteins – such as lentils, quinoa, tofu, tempeh, and nuts – helps ensure adequate intake of all essential amino acids. Pairing iron-rich foods with vitamin C enhances absorption, and limiting reliance on soy can help maintain hormonal balance in sensitive individuals. Routine blood tests can help identify any deficiencies before they lead to more serious health issues. With mindful choices and attention to nutritional needs, a vegan diet can be both ethically rewarding and physiologically sound.

By Deetya N

The Cost of Healthy Eating

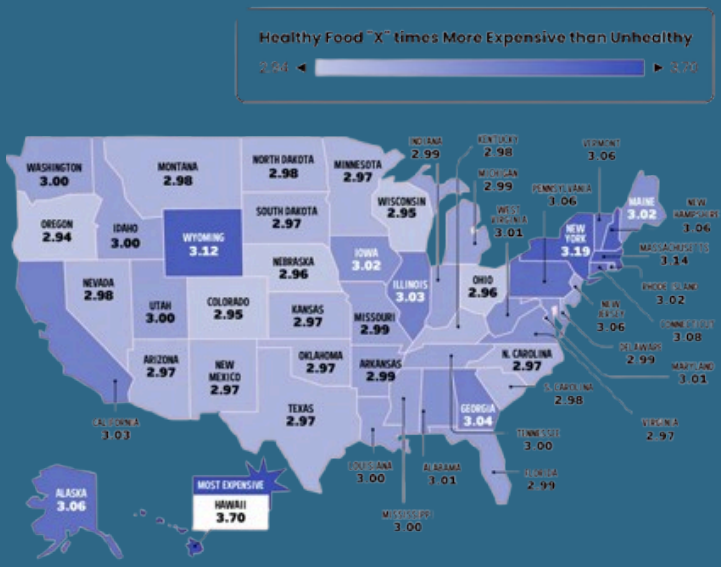
The present world produces more food than ever before. Agriculture and trade have advanced to the point where enough food exists to feed everyone. However, across every continent, millions of people still go hungry, or suffer from poor diets that lead to an increased risk of disease.

The underlying issue is not simply one of food availability, but rather of food affordability, pricing structures, and public investment priorities. The intersection of food, health, and economics reveals deep systemic imbalances that drive both hunger and diet-related diseases.



The UN Food and Agriculture Organization (FAO) reports that approximately 2.8 people worldwide can't afford a healthy diet (FAO et al., 2023). The global average cost of such a diet is $3.66 per person per day, but for many low-income families, this is more than they can spend on all their daily food.

This gap is worst in Sub-Saharan Africa, where more than 85% of people can't afford nutritious meals (FAO et al., 2023). Poorer households spend a large share of their income on food. Since healthier options like fruits, vegetables, and lean proteins cost more, families often have to rely on cheap staples like rice, cornmeal, and bread. These provide calories but lack essential nutrients (WHO, 2020).



Government farm subsidies play a big role in shaping food prices. In many wealthier countries, subsidies are directed at crops like corn, wheat, and soybeans, which are used to produce cheap processed foods. Meanwhile, fruits, vegetables, and legumes often receive little to no financial support (OECD, 2023).

This means the foods that are least healthy are often the most affordable. Economists call this a "nutrition penalty" – it costs more to eat well than it does to eat poorly (Hawkes et al., 2015). The price tags on food don't reflect the real cost of eating badly. Cheap, unhealthy foods might save money upfront, but they contribute to long-term health problems like obesity, heart disease, and diabetes. In the UK, diet-related illnesses cost the NHS around £6 billion each year, mostly due to obesity and its complications (Public Health England, 2017). While an unhealthy diet may seem more affordable in the short term, it often leads to higher costs for both individuals and public health systems in the long run.

Poor nutrition impacts not only public health but also hinders economic development. The World Bank estimates that countries lose up to 11% of GDP each

The Cost of Healthy Eating

year due to lower productivity, worse school performance, and rising healthcare costs caused by malnutrition (World Bank, 2021).

This issue extends beyond hunger alone. Many countries are now experiencing a 'double burden' of malnutrition, characterised by the coexistence of undernutrition and rising prevalence of overweight and obesity (WHO, 2020). Families may eat enough calories but still lack the necessary vitamins, fibre, and protein. These dietary gaps affect learning, earnings, and long-term economic growth.

Despite the relatively low cost, investments in nutrition remain insufficient, despite the substantial potential returns. The World Bank estimates that every $1 spent on child nutrition programs can return $16-$35 through better health and stronger economies (Shekar et al., 2017).

Many lower-income countries rely on imported food. This makes them vulnerable to price spikes caused by global crises. The war in Ukraine, for example, disrupted wheat and fertilizer exports and caused grain prices to rise sharply, worsening food insecurity across Africa and the Middle East (UNCTAD, 2022).

In addition, food is now traded on financial markets like oil and gold. Investors buy and sell futures contracts based on crops like corn or soy. This can make prices more volatile, even if actual supply hasn't changed (Clapp, 2014). For consumers with low incomes, sudden increases in price can be the difference between eating or going hungry.

The gender imbalance in farming also limits food access: women make up 43% of the agricultural workforce globally but have less access to land, tools, credit, and training (FAO, 2011). Closing this gender gap could boost farm output by up to 30%, potentially reducing the number of hungry people by 12–17% (FAO, 2011). When women are given equal support in agriculture, they not only grow more food, but are more likely to invest in children's nutrition and education, improving community wellbeing and economic outcomes.

While many food systems are failing to support nutrition, there are promising success stories that show how public policy and investment can make a difference:

- Brazil's "Zero Hunger" program combined direct cash transfers with school feeding, local food production, and support for small farmers. It helped reduce hunger and poverty dramatically between 2003 and 2014 (FAO, 2015).
- Mexico's soda tax, introduced in 2014, led to a 12% drop in sugary drink purchases in its first year, with the largest reductions among low-income households. Revenue was used to fund clean water and public health programs (Colchero et al., 2016).
- In Bangladesh, investments in rice fortification and maternal nutrition have helped reduce child stunting and improve school performance over two decades (World Bank, 2021).
- Ethiopia's Productive Safety Net Programme gives food or cash to the poorest households in exchange for work in community projects. It has improved food security and helped families cope with climate shocks (Gilligan et al., 2009).

These examples show that with the right policies, it is possible to improve diets, strengthen local economies, and reduce public health costs.

To close the gap between food supply and healthy nutrition, governments and organizations must take the necessary measures:

The Cost of Healthy Eating

- Support healthy foods by shifting subsidies toward fruits, vegetables, legumes, and sustainable farming methods.
- Tax harmful products like sugary drinks and ultra-processed snacks and use the revenue to fund nutrition programs.
- Invest in school meals, food vouchers, and community kitchens to help families access better food.
- Build infrastructure, such as cold storage and local markets, to improve access to fresh produce.
- Close gender gaps in farming by supporting women farmers with land, credit, and tools.

These steps not only help people eat better, but they also save money by reducing health costs and boosting productivity.

There is sufficient food produced globally, yet a significant number of people are unable to afford the diets necessary for maintaining good health. This issue extends beyond humanitarian concerns and represents a major economic challenge. Poor nutrition undermines health, economic development, and overall prosperity worldwide. Understanding the connections between economic policies, food systems, and public health is essential. By reconsidering how food is priced, subsidized, and taxed, it is possible to create a system in which nutritious diets are accessible and affordable for all, rather than a privilege reserved for some.

References

- FAO et al. (2023) The State of Food Security and Nutrition in the World 2023. Rome: Food and Agriculture Organization of the United Nations. Available at: https://www.fao.org/publications/sofi/en/ (Accessed: 18/06/25).
- WHO (2020) Malnutrition. Geneva: World Health Organization. Available at: https://www.who.int/news-room/fact-sheets/detail/malnutrition (Accessed: 18/06/25).
- OECD (2023) Agricultural Policy Monitoring and Evaluation 2023. Paris: Organisation for Economic Co-operation and Development. Available at: https://www.oecd.org/agriculture/topics/agricultural-policy-monitoring-and-evaluation/ (Accessed: 18/06/25).
- Hawkes, C., Harris, J. and Gillespie, S. (2015) 'Changing diets: urbanization and the nutrition transition', Global Food Security, 4, pp. 4-7. doi: 10.1016/j.gfs.2014.10.003.
- Public Health England (2017) Health matters: obesity and the food environment. London: Public Health England. Available at: https://www.gov.uk/government/publications/health-matters-obesity-and-the-food-environment/health-matters-obesity-and-the-food-environment--2 (Accessed: 18/06/25).
- Shekar, M., Kakietek, J., Dayton Eberwein, J. and Walters, D. (2017) An Investment Framework for Nutrition: Reaching the Global Targets for Stunting, Anemia, Breastfeeding, and Wasting. Washington, DC: World Bank. Available at: https://openknowledge.worldbank.org/handle/10986/26069 (Accessed: 18/06/25).
- FAO (2011) The State of Food and Agriculture 2010-2011: Women in Agriculture – Closing the gender gap for development. Rome: Food and Agriculture Organization of the United Nations.
- FAO (2015) Brazil's Zero Hunger Program: A Global Success Story. Rome: Food and Agriculture Organization of the United Nations.
- Colchero, M.A., Popkin, B.M., Rivera, J.A. and Ng, S.W. (2016) 'Beverage purchases from stores in Mexico under the excise tax on sugar sweetened beverages: observational study', BMJ, 352, p. h6704. doi: 10.1136/bmj.h6704.

By Charvi K

The Impact of Arthritis on the Individual and Society

Arthritis is a long-term condition affecting a crucial part of the human body responsible for stability, movement and bone connectivity- the joints. The fact that this condition does not have a permanent cure makes the subject of this essay even more significant, as currently 350 million people worldwide continue to live with the adverse impacts of arthritis. The topic of this essay presents the opportunity to explore how the impacts of arthritis can differ based on individuals' circumstances, as well as the less known implications of this painful condition on the wider society.

Physical Impacts on the Individual

The most prominent impacts on the individual would be the physical impacts of this condition on their musculoskeletal system; the wearing away of the joints leading to pain and inflammation is the most common impact of arthritis. Arthritis itself is an overarching term for conditions primarily impacting the muscles, joints and bones. Other than the two most common types of arthritis, osteoarthritis and rheumatoid arthritis, there are many other variations which can be triggered by related conditions or result from an injury. [1] Osteoarthritis, a condition initially affecting the smooth cartilage leading to the rubbing of bones near the joint, results in pain and stiffness surrounding the joints. [1] This severely restricts the individual's ability to complete everyday activities such as going to work or completing household chores independently. In addition, the overworking of tendons and ligaments could even lead to the formation of bony spurs known as osteophytes. [1] Rheumatoid arthritis is triggered by an autoimmune response in the body and is known to be a more rapidly worsening condition. [1]

Psychological Impacts on the Individual

Dealing with these physical challenges can elad to negative impacts on the individual's psychological wellbeing too. Firstly, the unpredictaility of the symptoms makes it difficult for those affected to follow rigid schedules.[2] For example, joint stiffness can flare up in the morning, thereby not allowing the individual to cope with jobs that have fixed start times. [2] Long waiting lists to see specialists can psychologically drain them. The individual could experience a lack of freedom or fall behind on their work leading to further stress, anxiety and depression.

Differing Impacts between Individuals

Another key factor we need to consider about the impacts of arthritis is how they differ based on the individual's unique circumstances. To overcome or manage physical challenges posed by arthritis, affected individuals may opt to modify their homes to suit their condition, for example by installing handrails to aid their movement. However, this may not be practically or financially possible for some people who may be renting homes or simply cannot afford these modifications. This unveils how socioeconomic factors such as one's income levels and the development of the country they live in can affect their access to adequate healthcare and the severity of the impacts they face. An individual's health levels greatly impact the severity of the impacts they face, for example an overweight person would experience more pain in their joints than an individual with a healthy weight due to the additional force that is exerted onto their joints. [1] Therefore, it is important not to generalise the impacts faced by all individuals with arthritis.

The Impact of Arthritis on the Individual and Society

Impacts on Relatives and Friends

When we consider the wider society, the first layer of a person's social circle involves their friends and family who also experience the impacts of the individual's condition. These are the people who are most likely to take the responsibility of caring for the affected individual. Some family members may even take financial responsibility for the affected individual to ensure they can access relevant healthcare facilities. This may result in a financial burden especially if they must take time of off work to care for the affected individual. As well as a financial burden, they may also experience an emotional burden when viewing their loved one suffer or even deteriorate with this condition. On the other hand, there may be some positive impacts such as more awareness on arthritis within a community. Witnessing a known person go through the impacts of arthritis would reinforce the importance of the preventative measures one should take to prevent developing the same condition. With the world being more interconnected than ever through the internet and social media, people with arthritis are making use of online platforms to share their experiences of living with its impacts. This helps others in the society, who may be in the same situation, to feel more supported. Moreover, key support networks for those in the wider society with arthritis includes the National Rheumatoid Arthritis society which is a national charity supporting people living with rheumatoid arthritis. [4]

Impacts on the wider economy

The impact of arthritis on the economy would undoubtedly create further impacts on the wider society too. Arthritis has important financial impacts on the economy. The estimated cost of osteoarthritis and rheumatoid arthritis to the NHS over a decade (as of 2021) is £120 billion. [3] This shows that arthritis management takes up a reasonable share of overall NHS costs, which otherwise could have been invested into cutting down waiting lists - a pressing issue that directly impacts the wider society. Osteoarthritis is the reason for 97% of the knee replacement surgery waiting list. [3] Data shows that 28 million working days are lost each year due to musculoskeletal conditions in the UK which severely impacts the productivity of the UK economy. [3] Overall, this proves that arthritis creates a burden on healthcare services thereby weakening the UK economy and negatively impacting the wider society.

In conclusion, the impacts of arthritis are more far-fetched than just the physical impacts on the individual. It branches out to impact psychological wellbeing, awareness in the wider society as well as the productivity of an economy. The complexity surrounding differing impacts proves that each individual's experience of arthritis is unique as well as highlighting how further improvements are required to make healthcare more inclusive to all.

References

1. NHS, 'Arthritis' (UK, Crown copyright, September 2022), https://www.nhs.uk/conditions/arthritis/
2. Sarah Ryan, 'Psychological and social needs of people with rheumatoid arthritis' (British Journal of Nursing, March 2023), British Journal of Nursing - Psychological and social needs of people with rheumatoid arthritis
3. National Institute for Health and Care Excellence, 'NICE impact Arthritis' (NICE, Manchester, January 2022), https://www.nice.org.uk/Media/Default/Get-involved/Meetings-In-Public/Public-board-meetings/nov-22-pbm-arthritis-impact-report.pdf
4. National Rheumatoid Arthritis Society, https://nras.org.uk

By Prethika R

specialised fields

The Cost of Compassion: Burnout in Vet School

It's not uncommon to perceive veterinarian students as resilient, passionate and having mastered an excellent work ethic however though this is true for some for many this is a façade. Behind the drive to improve animals' lives lies a worrisome truth: Many students are struggling with burnout and compassion fatigue. These terms describe genuine mental health concerns that are often either overlooked, misunderstood, or dismissed altogether, but the effect on future vets is increasingly evident. It is standard for these terms to be dropped into conversation, but what do they mean?

Burnout refers to a state of emotional and physical exhaustion stemming from prolonged stress usually associated with feelings to detachment and/or a reduced sense of accomplishment. On the other hand, compassion fatigue, as the name suggests, is a result of caring deeply for others who are suffering and the emotional strain that comes with this. Therefore, it is unsurprising that vet students are so vulnerable to these mental health challenges as the two frequently overlap throughout all aspects of vet life.

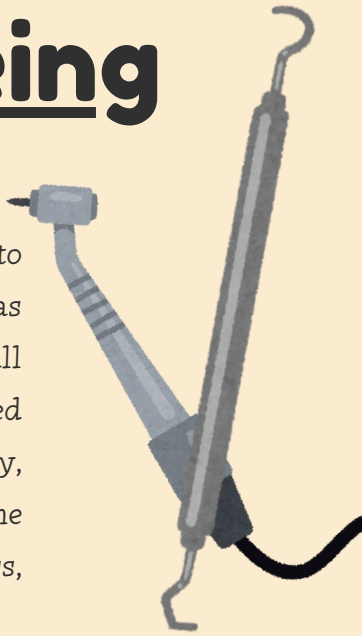
According to a 2018 study published in the Journal of Veterinary Medical Education, 30% of vet students were at an elevated risk of burnout, and 24% experienced ignificant symptoms of secondary traumatic stress. Although it is true that most professions are stressful the long and unpredictable hours of a vet student along with the constant exposure to suffering animals and the incessant pressure to perform academically makes mental health struggles all too common.

Many students become subject to imposter syndrome, feeling as if there are not good enough due to the expectation to be tough within vet culture. Furthermore, it is accepted by students that witnessing the sheer volume of patients of whom some cannot be saved plagues their ability to make compassionate choices.

But there is hope! If you can recognise how burnout and compassion fatigue begin for you, it is possible to learn to cope and improve your mental wellbeing. Through utilising mentor schemes, peer support, prioritising rest and setting boundaries life as a vet student can be less stressful and more rewarding. Moreover, institutions are trying to reinvent wellness culture in the veterinary profession thus mental health support systems are becoming increasingly accessible and Organisations such as Vetlife in the UK and Not One More Vet globally are leading necessary discussions about mental health in the field. It important to remember that truthfully choosing a career in veterinary medicine could be considered the epitome of deep compassion but it must not come at the cost of personal wellbeing.

By Carrin R

The Mouth Matters: How Your Oral Health Shapes Your Overall Wellbeing



Is the Mouth the New Heart?

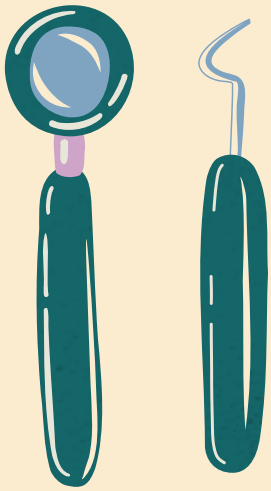
For centuries, medical professionals and patients alike perceived the heart to be the central organ governing life and vitality; however, research has started to suggest that oral health may be just as crucial to our overall wellbeing as cardiovascular health. Before the existence of the advanced dental technology and sleek dental practices we are familiar with today, dentistry was far from the precise science it has become. In fact, up until the mid-eighteenth century, the main providers of dental services were barbers, who were known as barber-surgeons in the Middle Ages and into the renaissance, owing to the fact that they performed a range of medical procedures, including tooth extraction and minor surgeries. It was not until 1745 when King George II passed the Barbers and Surgeons Act 1744 that surgeons were officially separated from barbers. Dentistry did not emerge as a recognised profession until the 19th century, as society became increasingly aware about the importance of oral health and how it shapes our overall wellbeing.

The Link Between Oral Health and Cardiovascular Health

The connection between oral health and cardiovascular health has become increasingly evident, with research proving that poor oral hygiene can put individuals at higher risk for heart disease, stroke and diabetes, among other medical issues. To give an example, insufficient brushing and flossing can enable plaque to accumulate on the teeth, which if left unremoved, can harden into calculus. This in turn can result in initially gingivitis (the early stage of gum disease) which if left untreated, can progress to periodontitis (its more serious, irreversible equivalent). A study published in 2018 highlighted the "moderate correlation between tooth loss and coronary heart disease". According to the World Health Organisation, individuals living with untreated oral infections such as gingivitis and periodontitis are at a 70% higher risk of developing cardiovascular complications.

The Psychology of a Smile: Oral Health and Mental Wellness

The medical significance of oral hygiene does not simply stop at your physical health-the state of your teeth and gums can also influence other aspects of your wellbeing, including your mental health. Leaving oral conditions untreated can elevate the likelihood of raised stress levels, poor sleep quality and mental health conditions, such as anxiety and depression. An article posted in 2023 on Psychiatric News by Antoinette V. Shappell, M.D. and Pierre M. Cartier, D.M.D., M.P.H explored numerous ways in which oral health and mental wellbeing are interconnected. The article emphasised how "poor oral health can result in tooth loss and compromised speech and aesthetics, adversely affecting self-esteem, socialisation, and occupational engagement". On top of this, Bupa UK claims nearly half (44%) of the UK population claim to have some degree of fear surrounding dental care and thus have avoided undergoing procedures which would benefit, and in many cases be vital, for their dental health. As a result, chronic oral pain can arise, which can contribute to poor mental health and thus complicate treatment.

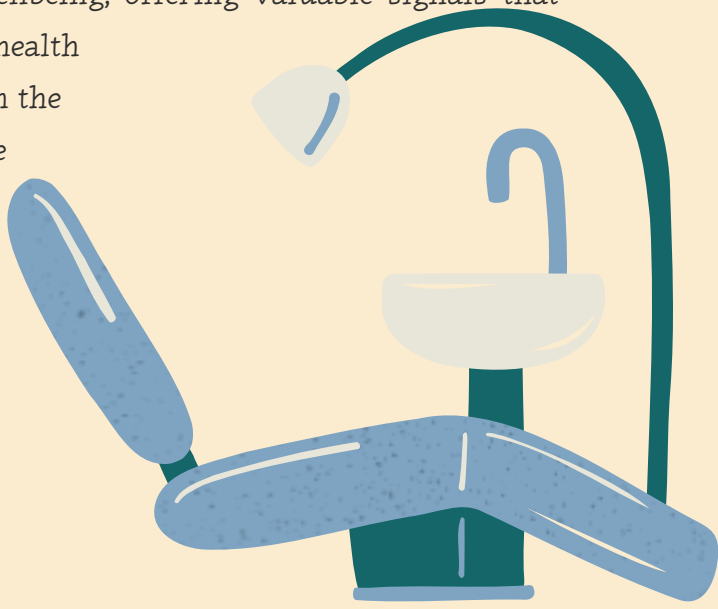


Silent Signals: What Your Mouth Reveals About Your Wellbeing

As unsuspecting as you may believe you seem when you lie to your dentist at your six-month check-up about brushing and flossing your teeth twice-a-day, both your mouth and dentist are always a step ahead, revealing and interpreting silent signals regarding your wellbeing. To give an idea, ongoing bad breath may warn of underlying medical complications, such as diabetes or digestive problems, whereas tooth discolouration and wear, as well as gum recession can be indicative of calcium deficiency, or stress-induced habits like teeth grinding.

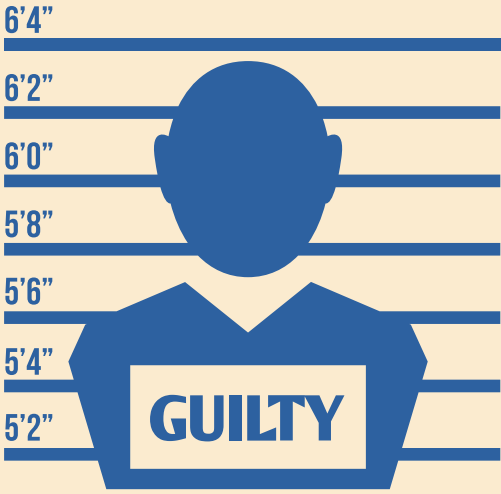
Conclusion

Your mouth is your best friend: your pearly whites reflect not only your oral hygiene habits, but also the condition of your overall wellbeing, offering valuable signals that could contribute to early diagnosis and improved health management. So, next time you find yourself sat in the dentist's chair, remember- it is not only your smile they are serving, but your overall wellbeing.



By Joely L

Forensic Pathology - How Medicine Plays a Role in Criminal Investigations

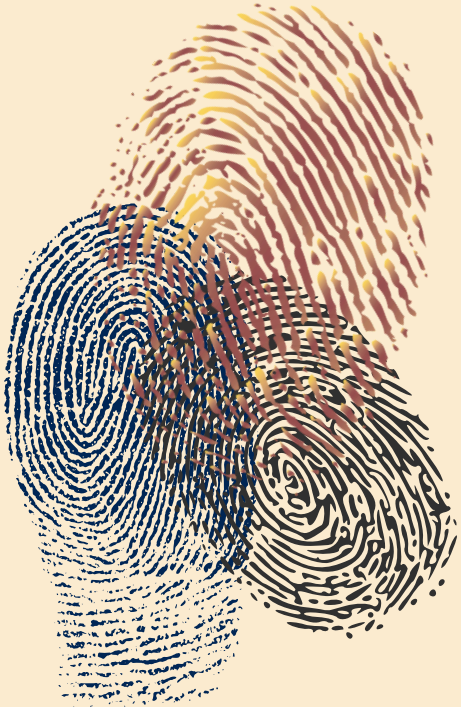


What is forensic pathology?

Forensic pathology is a specialty of pathology (the study of disease) that focuses on determining the cause of death by examining a corpse. A postmortem examination is performed by a medical examiner or forensic pathologist, usually during the investigation of criminal law cases and civil law cases.

Why is it important?

Forensic pathology is important in death investigations, especially in homicide or suspicious deaths, because it helps determine the cause and manner of death, which is required for justice and legal proceedings. Forensic pathologists also give critical evidence for criminal investigations, help identify victims, and aid in comprehending the circumstances behind a death. Forensic pathology can detect patterns of damage or sickness that may signal public health concerns, such as the presence of harmful substances or violent behaviours.
Research and practice in the field can help to improve our understanding of the human body, disease, and injury, which can be applied to other fields of medicine.



What do forensic pathologists do?

The main aspect of their role is to conduct autopsies (a post-mortem examination to discover the cause of death or the extent of disease) and to examine bodily fluids and tissue samples for things like poisons or drugs, but there are many other ways they collect evidence. For example, using ballistics, which is the analysis of the trajectory and impact of firearms, can be used to determine the type of gun used, the position of a shooter or the pathway of a bullet though a victim. Collecting trace evidence such as fibres, paint chips, soil and vegetation that can link suspects and victims to a location or each other.

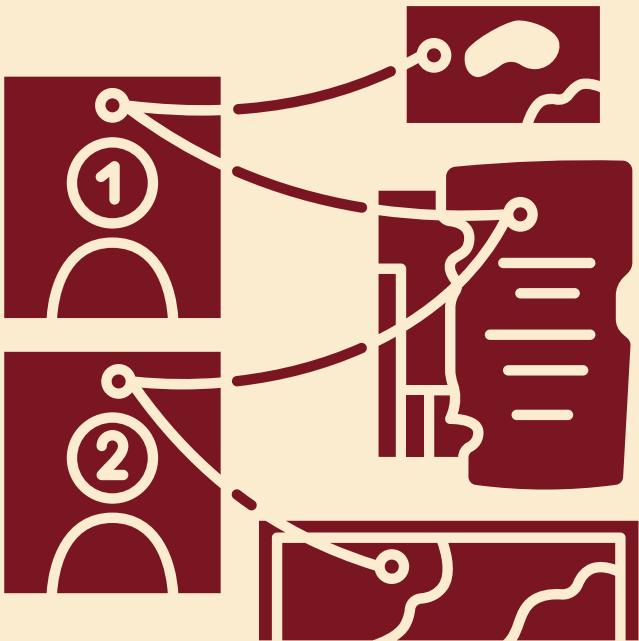
Physical evidence at the scene can also be used. Latent fingerprints can be found at the scene and matched to individuals, shoe and tire impressions can be matched to specific footwear or vehicles, and fracture patterns which analyse how glass or tape breaks can provide information about the events. As medical professionals, forensic pathologists need to prove and explain their findings similarly to how a doctor working in a hospital would have to explain their diagnosis to a patient or justify a treatment plan. For this reason, and to aid the ongoing investigation, forensic pathologists may be called upon to provide expert testimony in court to explain their findings and conclusions, which may be crucial parts of evidence for the prosecution or defence.

Dissection Techniques

There are many techniques for extracting and examining organs. Popular techniques include Virchow (one-by-one removal), Letulle (en masse removal), Ghon (en bloc removal), and Rokitansky (in-situ dissection). Each technique has benefits as well as drawbacks, and the choice is based on the unique situation and the pathologist's preferences.

Virchow's Method, which is the most typical strategy, is to remove organs one at a time. Letulle's Method (en masse) where the organs of the chest and abdomen are removed as a single block and then dissected further. This approach preserves organ relationships and is potentially speedier, but it is also more labour intensive. Ghon's Method (En bloc): Organs are removed in blocks (for example, thoracic, abdominal, and pelvic), which can be easier to manage than a single huge block while keeping some organ links. Rokitansky's Method (in situ): Organs are dissected within the bodily cavity but not completely removed. This approach is effective when organ preservation or limiting exposure is critical. The autopsy starts off with incisions to get to the body's sections. Common incisions include a Y-shaped incision for the chest and abdomen, as well as a midline incision then organs are removed in one of the ways mentioned.

Each organ is thoroughly inspected both outwardly and inside for any anomalies or signs of disease. This includes evaluating the size, weight, colour, and texture. Tissue samples are collected from various organs and examined under a microscope (histology) to discover altered cells and validate diagnoses. Organs like the heart, lungs, liver, kidney, and brain are dissected and examined by weight, texture, and colour to detect abnormalities and are inspected for trauma.



The Case of Mary Blandy: Poison, Inheritance, and Early Forensic Science

Mary Blandy was a well-educated woman from a respected English family in Henley-on-Thames. Her father, Francis Blandy, was a successful and well-known lawyer. Mary had romantic feelings for Captain William Henry Cranstoun, a Scottish aristocrat who was already married, which he kept from Mary and her family. When Mary's father discovered Cranstoun's deceit, he banned her from continuing their relationship, and the story goes that Cranstoun, desperate to get Mary's substantial inheritance, encouraged her to poison her father under the cover story that it was a "love potion" that would convince him to accept their love. So, in 1751, Francis Blandy became extremely sick and died under unusual circumstances. His symptoms included: Severe stomach pain Vomiting and diarrhoea and fatigue and gradual loss of strength. These symptoms were in keeping with arsenic poisoning, which was a popular murder method at the time because arsenic was readily available (used as rat poison) and had no taste or smell.

This case was noteworthy because it was one of the first instances of chemical analysis being used in a court of law, even though the Marsh test—the first accurate test for arsenic—was not developed until 1836. Francis Blandy was examined by local physicians and chemists, who noted any odd symptoms and stored samples of his bodily fluids and vomit, which was a relatively new concept then. Using crude chemical testing, a local doctor named Dr. Anthony Addington determined that the white substance he found in the vomit was probably arsenic. This early effort laid the groundwork for the scientific analysis of poisons in death investigations.

Mary Blandy was caught and tried for parricide (murdering one's father), which was considered particularly horrible in 18th-century England. Despite claiming that she believed the chemical was not harmful and designed to help her father respect Cranstoun, the jury sentenced her guilty. She was hung in 1752, and the trial received widespread public attention, particularly due to her class, education, and gender. This case was widely studied for its importance in the development of forensics as it set a precedent for keeping biological evidence for chemical testing. It demonstrated the need for trained medical examiners to assist in court matters. It contributed to the eventual establishment of forensic toxicology as an area of study and emphasised the need of distinguishing between natural disease and purposeful poisoning—an essential skill in forensic pathology.

By Abigail R

Bats don't get cancer? - how this could change cancer treatment in humans

Associated with haunted houses, horror films, and dark, spooky caves, bats serve as an omen of bad luck or death, in western media. But what if they could be the answer to battling one of the world's leading killers? Bats are unique physiologically. Usually, an animal's size relates to its lifespan, meaning a smaller animal lives a shorter life. This is because their genetics don't do much to protect them from cell damage over time; bats, on the other hand, live for 20 to 40 years (some species can even live the human equivalent of 180 years!), which is much longer than expected, compared to animals of similar sizes. Another interesting feature is that cancer is extremely rare in bats. Cancer usually arises from genetic damage over time and the fact that they are very metabolically active would normally increase the likelihood of developing tumours, as the byproducts from the reactions break up DNA.

Why don't bats get cancer?

Bat cells are more susceptible to developing tumours, as they only need two pieces of genetic damage to become cancerous. In contrast, a human cell needs three to eight pieces of genetic damage. So, why don't bats get cancer? A research team from the University of Rochester, led by Vera Gorbunova, PhD, and Andrei Seluanov, PhD, discovered key information in how bats don't develop this deadly disease. Both bats and humans have a gene called p53 and it is a tumour suppressor gene. This means that its activity stops tumours from forming. In humans, mutations in the p53 gene occur in around half of all cancers. A species of bat, known as the little brown bat (scientific name: Myotis lucifugus) has been found to contain two copies of the p53 gene and have elevated activity levels of this gene compared to humans – this means that cancer cells can be killed before they become harmful, by a process called apoptosis (cell death).

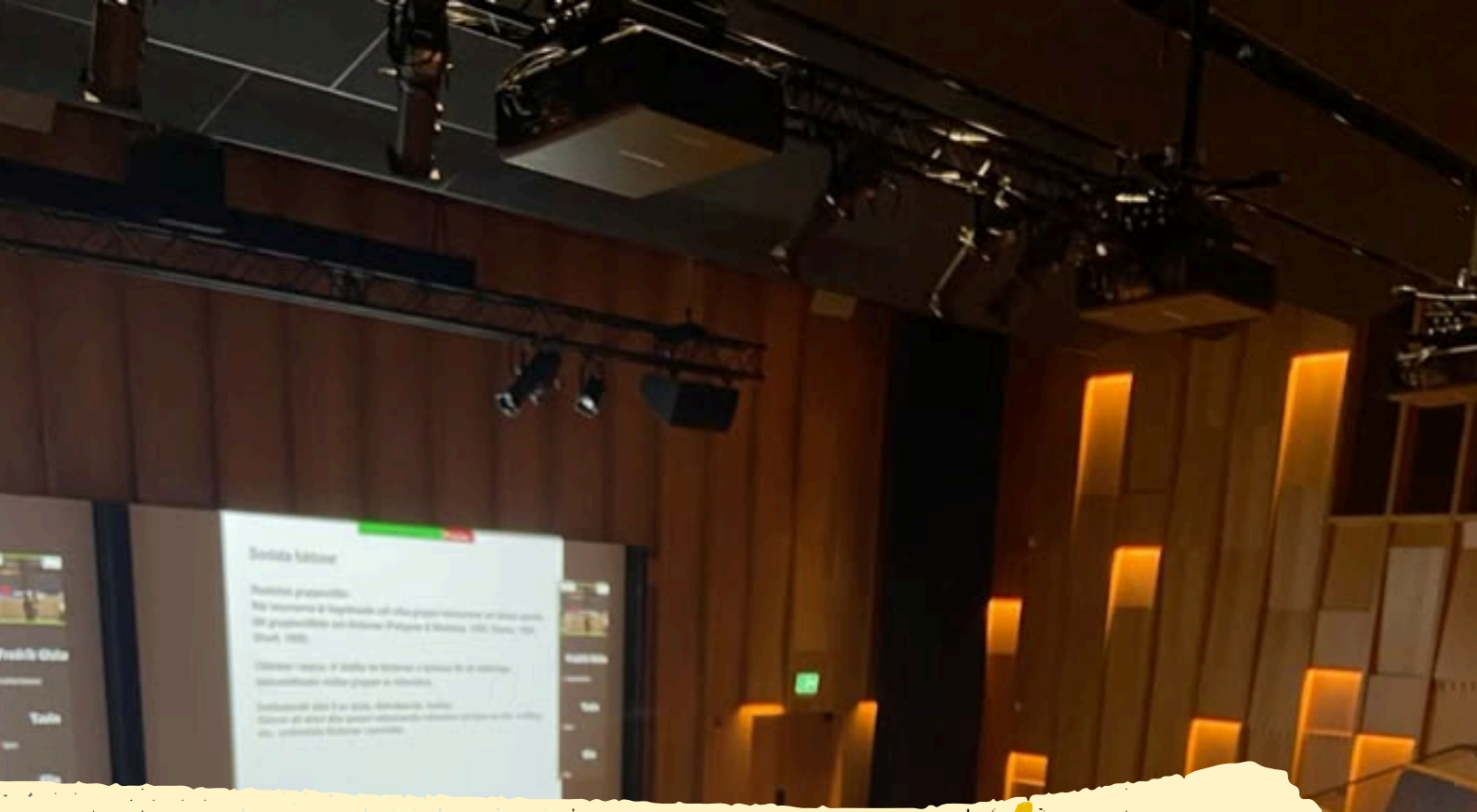
If the levels are too high, this can damage many cells, which may be healthy, but bats have developed a system that keeps them balanced between apoptosis and protecting healthy cells. Bat cells also have the enzyme telomerase. This enzyme helps keep cells alive by adding DNA to telomeres, which are located on the ends of a chromosome, protecting the ends of the chromosomes from damage. Every time a cell divides, the telomeres lose DNA, making them shorter. Over time, this means that the chromosomes become damaged, and the cell then dies. In this way, telomerase allows cells to divide indefinitely. This increases tissue regeneration in aging and injury. Even if cells became cancerous and began to divide rapidly, the p53 activity would shut this down quickly. In addition to this, bats have a very highly performing immune system, and this level is maintained throughout their lives, reducing the onset of any age-related diseases. Any pathogens that enter the body are quickly destroyed, and this can contribute to the cancer-fighting system in their bodies, as the antigens on the tumour cells can be instantly recognised and wiped out. It's not that bats don't get tumours at all – it's just that their bodies are rapid in fighting it, so that it's gone before the damage can be done.

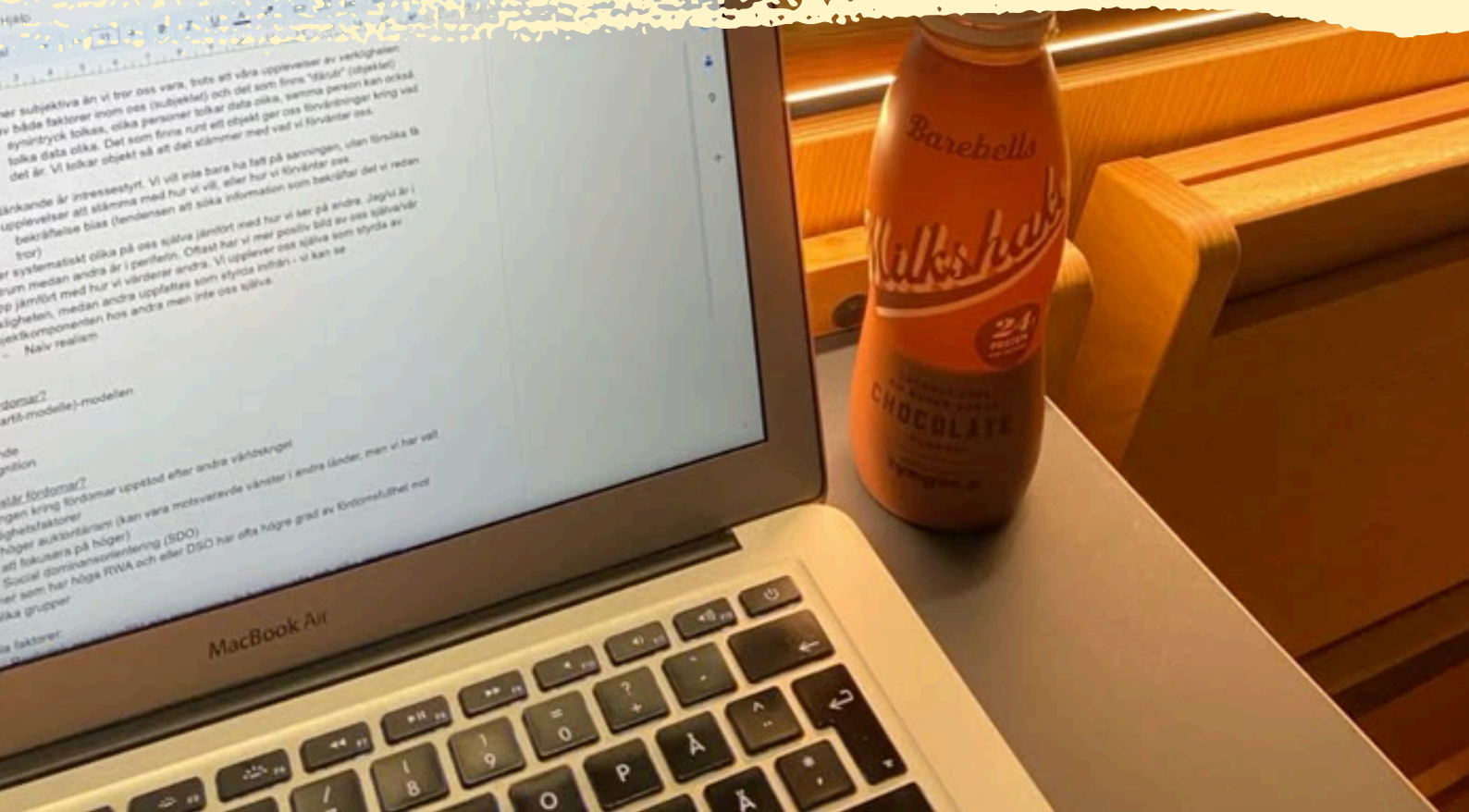
How can we use this in our battle against cancer?

Since their cells are susceptible to cancer, this makes them useful in cancer research. There have been many experimental drugs which have been developed which increase the activity of the p53 gene by targeting it; this has been confirmed to be a good defence against this condition by slowing the growth of the mutated cells or eliminating it entirely. Another method, which is currently only hypothesised, is increasing the levels of the telomerase enzyme – this could slow down the aging process of the cell, but it could also lead to an increased risk of cancer. Therefore, it is best to use this method in addition to increasing p53 activity, as uncontrolled growth can be kept under check. Overall, bats could be the key to unlocking the secrets of eliminating cancer, by serving as a blueprint on a cellular level. One day, we might get therapies which incorporate these methods to be used in public healthcare, saving millions of lives, and with our rate of medical advancements, we may not be as far from this optimistic reality as we might think.

By Manasvi B

University Advice Corner





Advice from a medical student

Who is better to give advice than someone who's already been through the process? In this edition's University Advice Corner, we have Javee Vesly, who has just finished her second year of medicine at the University of Cambridge. She's an ex-student of CCHS, having completed her journey here in 2023. We've asked her a few questions which medicine applicants for the 2026 entry may have, and here's her insightful advice:

What's your advice for UCAT?

- UCAT is all about practice. Keep going through questions and under exam conditions. Learn all the shortcuts (ie, for next question and flagging) to save time.

How do I choose the right university for me?

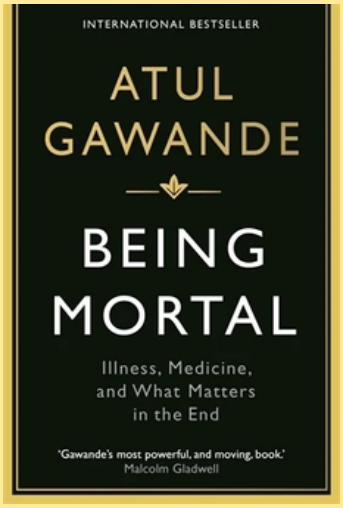
- To choose the "right" university for you, you need to decide what is important for you: do you want to be close to home, live in a city with a bustling nightlife, play a specific sport etc. The important things to consider when picking a medical university are the clinical exposure, anatomy teaching (is it dissection or prosection), and teaching style. I would also suggest looking at their entry requirements and interview style, as some prefer MMI to the traditional style.

How do I prepare for interviews?

- I would recommend you practice talking about the subject. Close to interview time, if I were studying, I would study aloud and ask questions aloud. That helped me explain what I knew, ready for interviews. Practicing with people also helps. This puts you under a bit of stress, and you can help each other with interview skills. Also, practice lots of interview questions, read the news, and know the common medical-law case studies, as this is often a key source of questions.

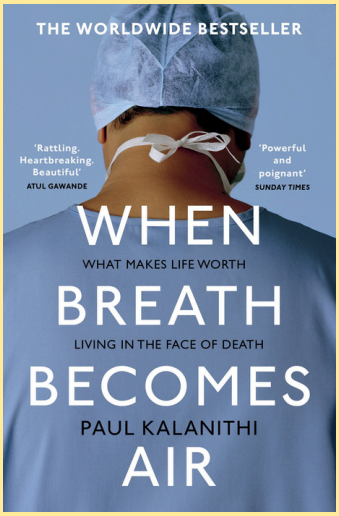
Summer Reads

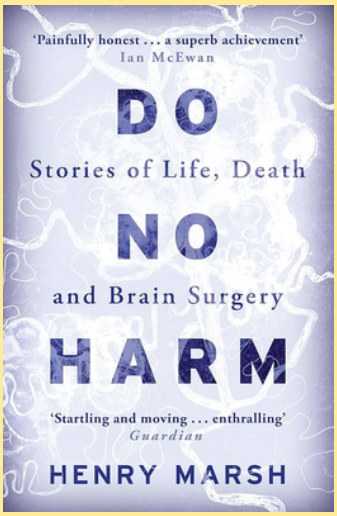
Reading books related to medicine is a great super-curricular activity as it shows you have a basic understanding of medicine and that you have an interest in the subject - it's a good topic to include in your personal statement and interviews. Make sure you understand the books in case you are asked about it at any point of your medical application - don't just include it for the sake of including it. Here's a list we've compiled that we believe are some good books. Happy reading!



Being Mortal
Atul Gwande
Witnessing limits in medicine as the relative of a patient

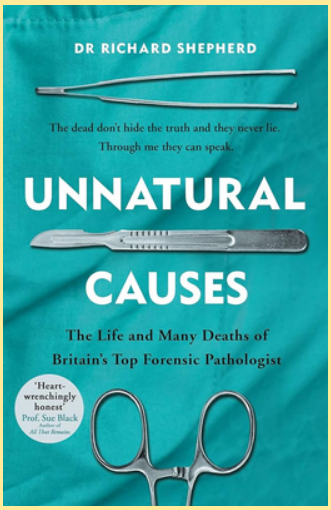
When breath becomes air
Paul Kalanithi
Experiencing lung cancer as a doctor and patient

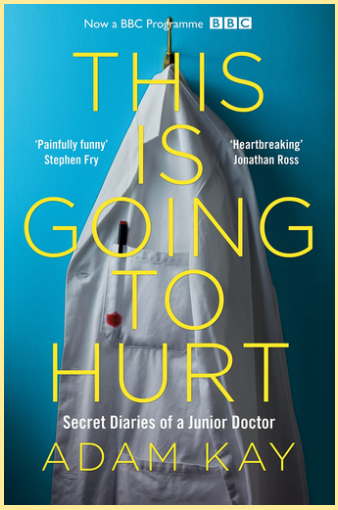




Do No Harm
Henry Marsh
The reality of working as a doctor and neurosurgeon

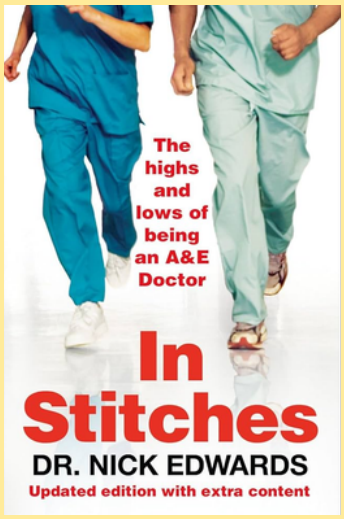
Unnatural Causes
Richard Shepherd
Exploring the causes of sudden and immediate death





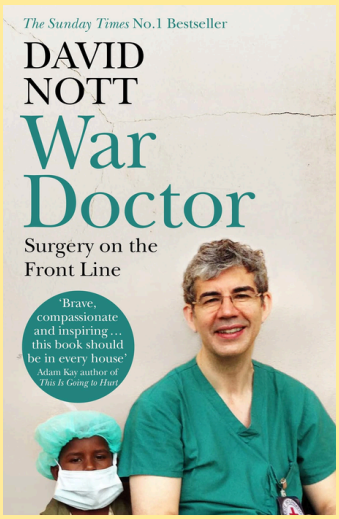
This is going to hurt
Adam Kay
Explores difficulties within junior doctor training

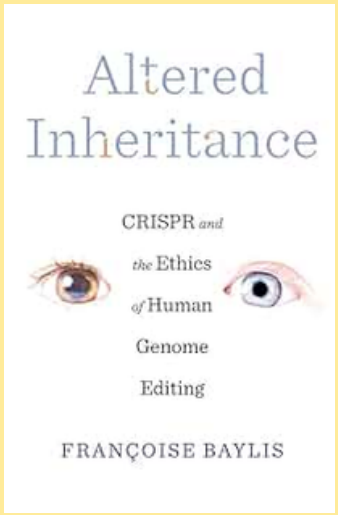
Trust me, I'm a (junior) doctor
Max Pemberton
Contrasts the ideals formed during medical school to finally working as a junior doctor.



In Stitches
Nick Edwards
Focuses on emergency medicine

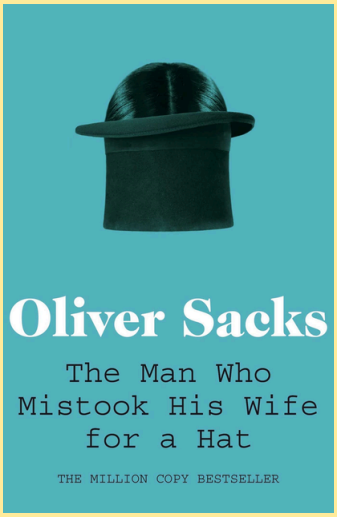
War Doctor
David Nott
Explores the difficulties of working as a front-line medic





Altered Inheritance
Françoise Baylis
Witnessing limits in medicine as the relative of a patient

The man who mistook his wife for a hat
Oliver Sacks
The first book in a trilogy exploring neurological disorders



🩺 Surgery Society Newsletter – Reflecting on the Past Three Terms & What's Next!

Dear Members,
As we wrap up a dynamic and engaging year, we wanted to take a moment to celebrate everything the Surgery Society has achieved over the last three terms and give you a sneak peek into what's coming next!

📚 Peer-Led Presentations: Learning from Each Other

This year, we've seen an incredible lineup of peer-led presentations, showcasing the talent and dedication of our members. Highlights have included:

- **Forensic Pathology** – A fascinating dive into the role of surgeons in criminal investigations and post-mortem examinations.
- **The Organ Transplantation Debate** – We tackled the question: Is the opt-out system truly beneficial? Members explored perspectives from ethics, public health, and patient autonomy.

⚖️ Ethics in Surgery: Challenging Conversations

Our sessions on ethical debates sparked thoughtful discussion and critical thinking. Topics have ranged from resource allocation in the NHS to consent in emergency surgeries. These conversations pushed us to consider the realities and responsibilities that future surgeons will face.

👩‍⚕️👨‍⚕️ The Surgical Career Path: What Lies Ahead

We explored the different types of surgeons – from cardiothoracic to trauma – and mapped out the journey to becoming a surgeon in the UK. These sessions were incredibly useful for those starting to consider their future specialties.

🧵 Quizzes & Clinical Skills: Making Learning Fun

We tested our knowledge through quizzes on various surgical topics, especially:

- **Suture Techniques** – Do you know your simple interrupted from your mattress sutures? Many of us do now!

🔍 What's Coming Next Term: Time to Get Hands-On!

We're taking things up a notch with more practical sessions in the works:

- **Suturing Practice** – Hands-on workshops to master key techniques.
- **Robotic Surgery Simulations** – Try your hand at the cutting edge of surgical innovation.
- **Dexterity Training** – With tools like "hit-the-target" exercises and even crochet, we're exploring fun and effective ways to boost our fine motor skills.

🧁 Surgery Society Bake Sale – Coming This Autumn!

We're excited to announce our **Autumn Term Bake Sale!** Whether you're a master baker or just in it for the brownies, join us in raising funds for a great cause.

- 📅 **Date:** To be announced
- 🎂 **All proceeds will go to Macmillan Cancer Research**, supporting people living with cancer and funding vital services.

If you'd like to contribute baked goods or help out on the day, keep an eye on our socials for details and sign-ups!

Thank You!

To all our members, presenters, and supporters – thank you for an incredible year of learning, collaboration, and surgical curiosity. We can't wait to see what we'll achieve together next term.

Stay sharp,
Your SurgSoc Presidents,
Leonor & Sachee

Thank you for reading!

Edition 10 - Woo! Double digits! 🥳
This edition wouldn't have been possible without all your fantastic contributions, ranging from how we can use genetic editing to fight cancer, to the medical ethics of squid games (those games are brutal).
Thank you for making this a special one!

This closes the academic year of 2024-2025 for MediMag+ and we look forward to see what you all have for us in the Autumn Term.

Have a great summer!

Your 2025 MediMag+ Editors :)