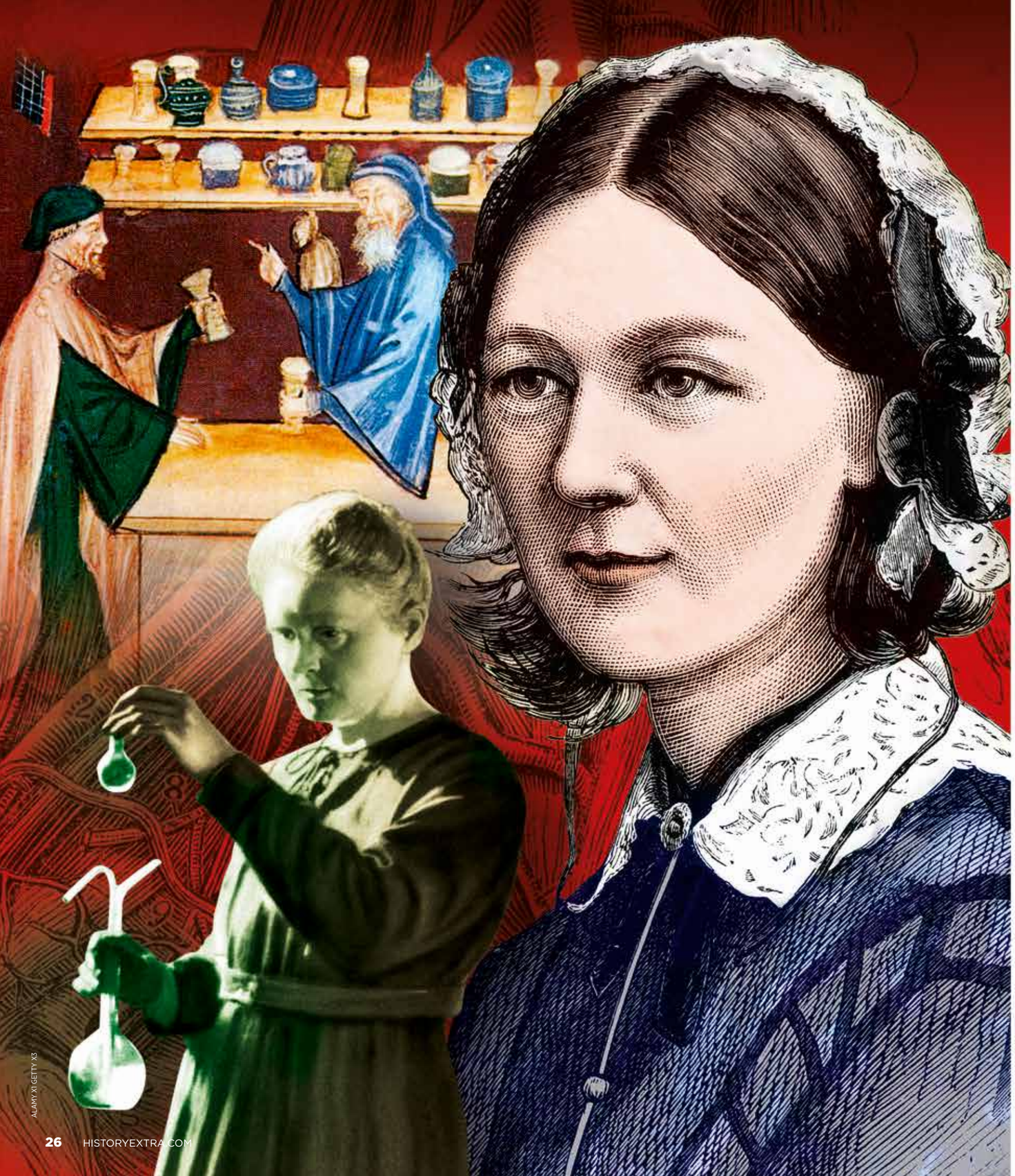

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YOUR ESSENTIAL GUIDE TO THE

HISTORY OF MEDICINE

The world's ongoing battle against Covid-19 has been a sobering reminder of our vulnerabilities as human beings. In spite of all our 21st-century luxuries, the fact that a microscopic virus can rampage across the globe and inflict the damage it has done remains difficult to comprehend.

Yet, with groundbreaking new vaccines being rolled out to tackle the current pandemic, it's hard not to marvel at the wonders of modern medicine, and just how much scientific progress has been made in order to have reached this point.

Over the following pages, we'll be charting the evolution of medicine over the past 2,500 years, revealing the ways in which our ancestors sought solutions to some of the worst maladies the world has ever seen: from typhoid and tuberculosis to syphilis, smallpox and the Black Death.

Along the way we'll meet a diverse cast of doctors and scientists whose discoveries transformed our understanding of the human body, while also answering key questions about public health through the ages. When were vaccines invented? Who was the first person to prove that germs were capable of causing disease? What on earth was a 'gong farmer'?

We begin over the page with a Q&A with historian Professor Mary Fissell, who also offers her expert insight throughout this essential guide...

MARY FISSELL is professor of the history of medicine at the Johns Hopkins University, Baltimore. Her work mainly focuses on how ordinary people in early modern England understood health, healing and the natural world.

EVERYTHING YOU WANTED TO KNOW ABOUT THE HISTORY OF MEDICINE

Professor Mary Fissell answers key questions on healthcare of the past

INTERVIEW: RACHEL DINNING

PODCAST
Professor Mary Fissell discusses the history of medicine on the HistoryExtra podcast. Listen at *historyextra.com/podcast*

Q: What would you say are the three biggest turning points in the history of medicine?

A: Every historian will have different thoughts on this, but I would say inoculation for smallpox, which made its way to Europe and the US in the 18th century. The West was pretty late to the party, though, as inoculation had already been taking place in Asia and Africa for a long time. Smallpox ravaged through populations, so the idea that human intervention could actually change lives was a really important milestone.

The next game-changer was germ theory in the 19th century – the discovery that germs cause disease. And the third turning point I would choose was the advent of contraception. The ability to make pregnancy a choice rather than a happenstance was really significant, and that started to become a more widely publicised thing in the early 19th century.

Q: Do you think it's fair to say that the history of medicine has been one of steady progress and continual improvement?

A: I don't think it's necessarily been a steady upward trajectory to get to where we are now. Of course, I'm certainly grateful that I live today – in a world of anaesthesia, antibiotics and antisepsis – but there are things we've lost as well as gained on the way here. Certain kinds of patient autonomy in terms of the ways in which patient narratives of illness were attended to in the past, for example. Today, they're often reduced to laboratory numbers and tests. Medical progress is a more complex picture than just onwards and upwards. Overall, of course, the advent of scientific medicine has been a tremendous benefit to humankind and has really changed the face of how we live.

Q: What advancements in medicine have occurred off the back of practices or experiments that we might consider unethical today?

A: Well, I'd go back to one of my earlier examples of inoculation, which was brought to England from Constantinople by Lady Mary Wortley Montagu. Condemned prisoners were offered the option of being 'guinea pigs' for inoculation – if they survived, they would be freed. That's not what we would call informed consent! I think six people were inoculated in total: three men and three women. And then one of the women had to nurse smallpox patients back to health to show that, in fact, she was immune.

ABOVE: **French chemist and microbiologist Louis Pasteur made huge breakthroughs in vaccines, germ theory and, of course, pasteurisation**

LEFT: **A medical illustration showing different forms of bacteria from the 19th century, when bacteriology was first being understood**

GETTY IMAGES X3, ALAMY X2

LEFT: **Prisoners were offered their freedom if they agreed to be guinea pigs for smallpox inoculations**

RIGHT: **US President Bill Clinton formally apologised for the Tuskegee Study in 1997 and met survivor Herman Shaw**

It was ethically wrong in every way, yet it did show that inoculation was safe and successful, and helped establish an inoculation movement, so it was a real advance.

Q: When did medical ethics on the idea of informed consent – when a healthcare provider educates patients about the risks or benefits of a procedure – come into practice?

A: Informed consent was really the product of the Nuremberg trials after World War II and the revelations of the horrific experimentations that had taken place in the concentration camps. Everyone recognised that a firm line had to be drawn, so that was really the first kind of codification of informed consent. There had been forms of medical ethics before the 20th century, but they hadn't really been focused as much on the patient. Often they were focused, in part, on a doctor's relationships with other doctors – how to behave professionally and act politely with your colleagues – as much as about a bedside manner.

The clinical study 'Tuskegee Study of Untreated Syphilis in the Negro Male' that ran from 1932 into the 1970s was a watershed moment in terms of the sort of harm that not attending to medical ethics could cause. The study in Tuskegee, United States, initially involved 600 black men – 399 with syphilis and 201 who were not infected – and was conducted without the patients' informed consent.

The infamously unethical Tuskegee Study ran for 40 years; here, one of the men involved is given an X-ray

The men, mostly poor sharecroppers from Alabama, were told they were being treated for 'bad blood' (a local term for ailments as varied as syphilis, anaemia, and fatigue) and received free medical exams, a free meal on the day of the exam, and burial insurance in exchange for being part of the study. In reality, none of the patients received any treatment at all, even those with syphilis. All that happened was that they were monitored until they died and then the family was asked to grant permission for an autopsy so that they could look at the pathological study of the damage syphilis had done to these men. The Tuskegee Study was initially meant to last six months, but ended up running for 40 years.

> **"None of the patients received any treatment... they were monitored until they died"**

When it was finally outed publicly by a journalist in 1972, everyone was appalled. But the results of the study were published in medical journals for decades between the 1930s and the 1970s, and somehow nobody seemed to think about how incredibly unethical the study was.

Q: Were there any repercussions in that case for the medical people involved?

A: The surviving patients – and there weren't many of them – and families eventually received an apology from the White House and sums of money that were supposed to be some kind of recompense. But I don't think we can possibly think that justice was truly done for those men and their communities.

The other thing I would want to add about the Tuskegee Study is that it contributed hugely to the kinds of distrust that many black Americans have of the medical profession. It caused ▶

real, long-lasting harm in terms of healthcare, access, trust, and the patient-practitioner relationship. The knock-on effects have been substantial. Many African-Americans know the story of the Tuskegee Study, as well they should.

Q: Have male and female bodies been considered medically different throughout history?

A: Yes, but in different ways. According to the theory of the four humours, women were thought to be colder and wetter than men, who were seen as hot and dry. That makes sense because everyone knows if you want to grow a new seed, a cool, damp field is a lot better than a hot and baked one, and since it was women whose bodies carried new life, it made sense to think that they were cold and wet.

So there was a whole set of explanations about how women were different. As humoral theory waned, we moved into a period where men and women were seen as being wholly different. Women's nerves were believed to be finer and more delicate, while men were more robust; men were ruled by their heads while women were ruled by their uteruses; women were irrational creatures, and so on.

From a gender-relation perspective, it was definitely a step backwards from humoral medicine. It really made women different in every cell of their body, and not in a good way. It's only in the much more recent past that we've come to understand gender and sexual differences in a more nuanced way.

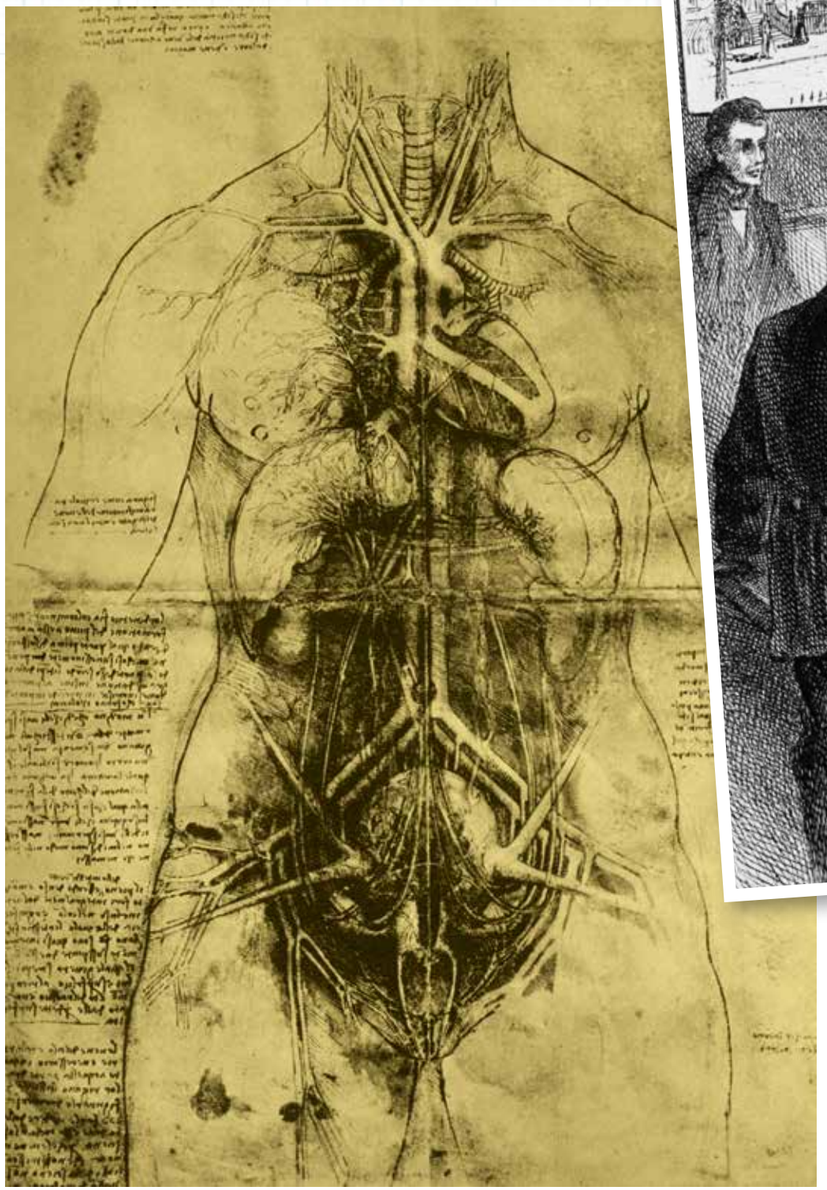
For much of the 20th century, in medical terms, man was seen as the default in every way and women were thought about only in terms of their differences to men. So in other words, you studied female anatomy if you had to learn about pregnancy and reproduction, but the male was the type and woman was the alternative. I don't think that really helped women's health very much.

Q: What are some significant contributions made by women to the practice of medicine?

A: Women have been healing in various ways since forever! It was only with the growth of universities in the 13th and 14th centuries that some people started to be labelled 'doctor'. And those people were men because you had to be male and know Latin in order to attend a university. But that doesn't mean there weren't women healers.

There's evidence from a trial in 1322 that's particularly striking. A woman named Jacqueline Felice de Almania was brought before the Paris Faculty of Medicine, which didn't like the fact that she was practising medicine. Felice gave a really interesting testimony in her defence, saying that she'd healed patients successfully, including patients that some of the male faculty had not succeeded in healing. Clearly, she was an experienced practitioner. Nevertheless, she lost her case under threat of excommunication.

Now, Felice was just one example, but there were probably many others like her.



A dissection of a woman by Leonardo da Vinci; under the four humours theory, women were seen as colder and wetter than men

"With the advent of universities, women had to practise medicine in the shadows"

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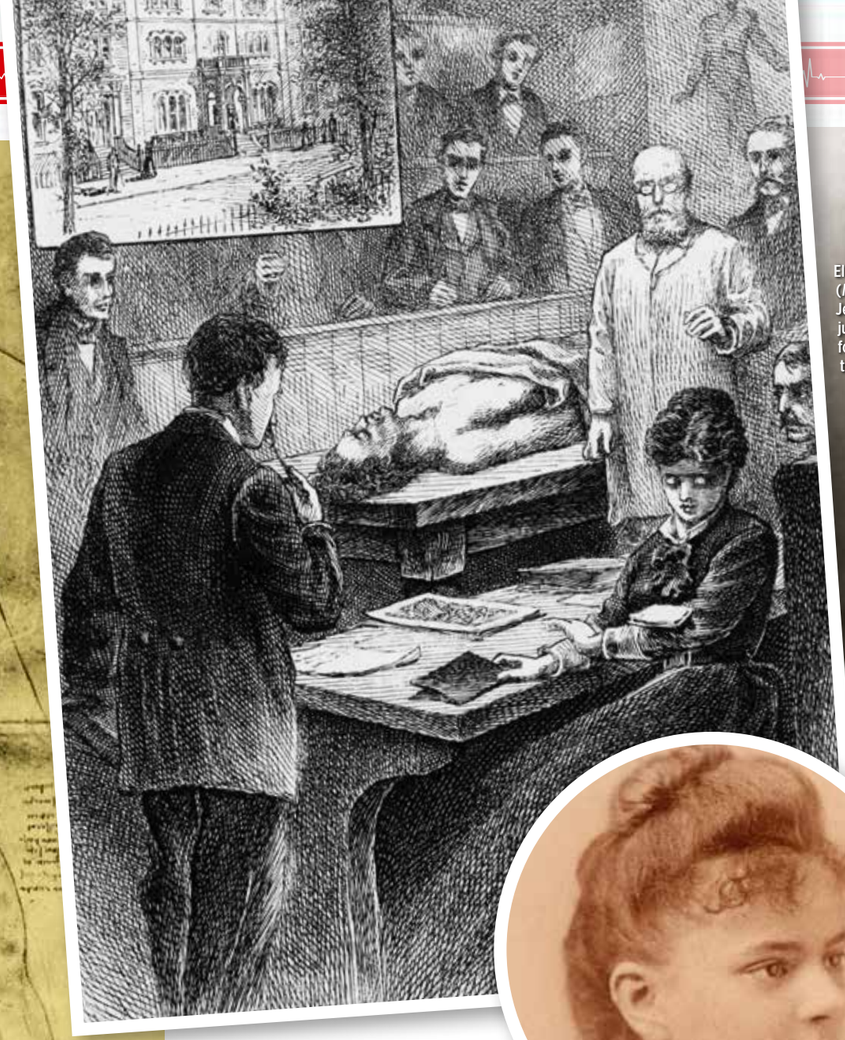


Elizabeth Blackwell was the first woman with a medical degree in the US and first woman on the British medical register

Elizabeth Blackwell (*left*) and Sophia Jex-Blake (*right*) were just two women who fought to be admitted to medical school

If not for Helen Brooke Taussig, blue baby syndrome would have claimed many more lives

We know there were plenty of women healers in the past, but with the advent of universities, they had to practise in the shadows more.

Technically, the first woman doctor was Elizabeth Blackwell, who was born in Bristol, UK, in 1821. Her family emigrated to the United States because her father was involved in abolition work and Elizabeth decided she wanted to be a doctor after she saw a female friend die a very painful death.

No medical schools would take her and when she applied to Geneva Medical College in upstate New York they didn't really know what to do with the request. So the faculty decided to let the students vote as to whether or not Elizabeth should be admitted. To the faculty's horror, the (male) students thought the idea of letting a woman study medicine was hilarious and said yes. Blackwell was admitted in 1847 and graduated in 1849, before returning to England for a while. She became the first woman on the British medical register.

It was really the foundation of women's medical colleges in the US during the 1850s when we begin to see women entering medical education in real numbers. It took longer in Britain, though. It was Sophia Jex-Blake and the so-called 'Edinburgh Seven' who finally stormed the citadel, as it were, and were actually allowed to go to medical school in Edinburgh in 1869. Shamefully, that did not allow them to graduate or qualify as doctors.

Once again, it was the establishment of medical colleges for women in Britain that created the space for women physicians. In both the US and Britain, these pioneering women started opening small hospitals where women could get clinical training. And that's really how women were able to become physicians.

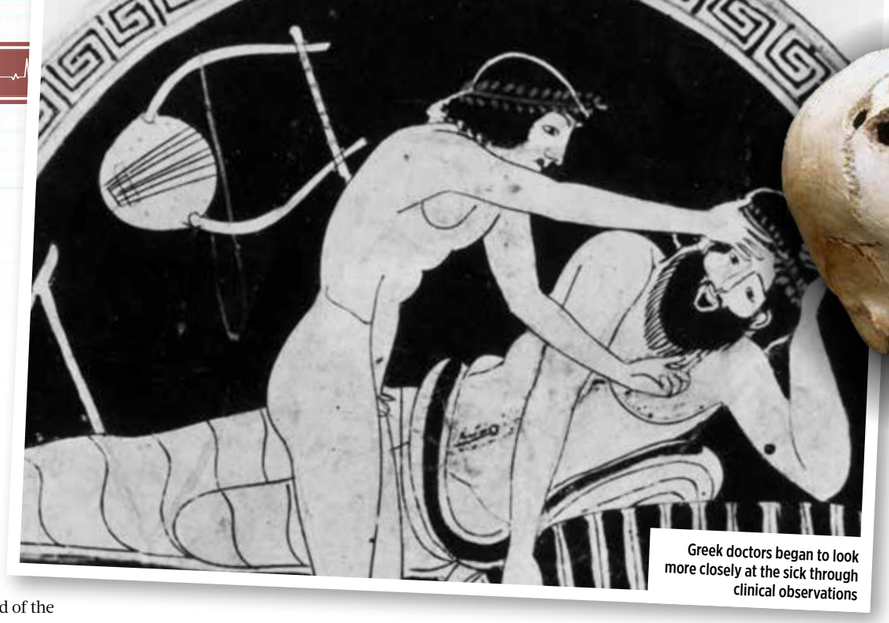
Q: For you, what is a really stand-out contribution to the history of medicine made by a woman?

A: Oh, I think it has to be paediatric cardiologist Helen Taussig's work – performed here where I am, at Johns Hopkins University – in the mid-20th century. She devised a means to improve blood oxygenation in babies born with Tetralogy of Fallot (also known as 'blue baby syndrome', where heart defects keep the blood so starved of oxygen that the baby appears blue). Taussig's procedure, developed with fellow surgeon Alfred Blalock and surgical technician Vivien Thomas, saved the lives of thousands of newborn babies and has come to be seen as the foundation of paediatric cardiology.

MEDICINE IN ANCIENT TIMES

People may have believed the body was made up of the four humours and prescribed mercury at will, but that didn't mean there were no ancient medical advances

WORDS: EMMA SLATTERY WILLIAMS



Greek doctors began to look more closely at the sick through clinical observations

Many diseases, infections and injuries that are easily treated today could have been tantamount to a death sentence in ancient times. In the days before life-changing advances like antibiotics and X-rays, vaccines and anaesthetics, one could be forgiven in thinking that ancient peoples did not make their own steps forward in medicine; yet great minds in ancient civilisations still strived to learn all they could about the human body – including how to look after and cure it.

One of the most important theories in ancient medicine was that the body was made up of four 'humours' – fluids that determined a person's health and behaviour. Humourism was "the bedrock of Western medicine for literally two millennia," according to Professor Mary Fissell from the Department of the History of Medicine at the Johns Hopkins University. The four humours – blood, yellow bile (also called choler), black bile (melancholy) and phlegm – were thought to correlate with the four elements of earth, air, fire and water; if they became unbalanced within the body, illness and disease was thought to occur. If a person was vomiting, for example, medical advice would have been to continue purging the unwanted fluids that were upsetting the humours.

The names most associated with the development and spread of the four humours theory are Hippocrates, the so-called 'father of Western medicine' in the fifth century BC, and Galen, the renowned physician of the second century AD, whose work treating the wounds of gladiators allowed him the opportunity to study the human body. Belief in the four humours would dominate Western medical thought for centuries to come.

The works of Galen, a physician of the Roman Empire, helped define medicine for centuries

From ancient times to the Renaissance, the theory of the four humours would be a medical mainstay

GETTY IMAGES X7

This 3,000-year-old prosthetic big toe, attached to the foot of an Ancient Egyptian mummy was made of wood and leather

> "We can't underestimate millennia of trial and error"

Ancient civilisations had their own unique ways of treating illness, including Ancient Egypt. "One of the earliest manuscripts we have on papyrus is about surgery," says Fissell. "The Egyptians were performing various kinds of surgery, including wound care and fractures; if there was a swelling on the surface of the body they would often try and remove it."

The papyrii that have been found describe anatomical observations, the diagnosis and treatment of diseases, and spells and incantations intended to ward off evil spirits thought to cause illnesses.

Archaeologists have also discovered artificial toes from Ancient Egypt – the earliest-known prosthetics.

POWERS OF OBSERVATION

Medicine had epochal breakthroughs in Ancient Greece, thanks in no small part to Hippocratic medicine. Not only did these doctors advocate a higher degree of professionalism and teaching, but they gave due importance to the power of observation: the physical examination of the body for the source of an ailment or watching an unwell patient to see how their symptoms progressed, ▶

These replica tools resemble what Neolithic people would have used for trepanning

PREHISTORIC MEDICINE

Even the earliest humans tried their hands at a surgery still seen today

If you thought that prehistoric peoples needed an understanding of surgery like they needed a hole in the head, you'd be right.

There is archaeological evidence from the Neolithic period of perhaps the world's oldest surgical procedure: trepanning. This involved drilling or cutting into the skull and removing a section of bone, usually circular in shape, which would have released pressure on the brain. Examinations of trepanned skulls have shown bone growth at the site of the hole, indicating that the patient lived for some years after the procedure.

It is possible that early trepanning was done to release evil spirits, but Fissell stresses that there may have been more to the procedure than this: "We should never underestimate millennia of trial and error and the kinds of observational powers of people in the past. If something worked, then you did it again."

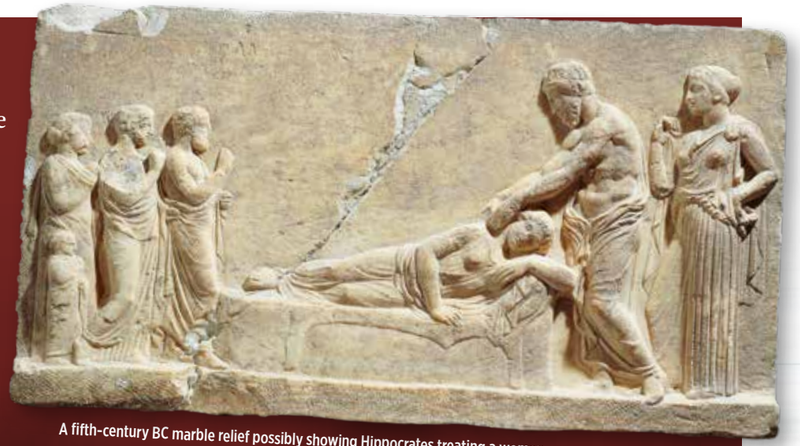
Prehistoric skeletons have also been found with healed fractures, suggesting that some knew how to mend bones. Fissell concludes: "Prehistoric man was doing what we think of as surgery and sometimes successfully, which is pretty remarkable."

HIP HIP HOORAY FOR HIPPOCRATES

The medical marvel of Ancient Greece

The fifth-century BC physician and philosopher Hippocrates is often named as the 'father of Western medicine'. He looked for rational reasons for illness and disease rather than relying on supernatural and spiritual causes.

The many works bearing his name – although it is unlikely he wrote all of them – influenced Western medicine for centuries, not least in the Hippocratic Oath, a declaration of ethics. To this day, doctors in many countries recite an updated version of the oath in recognition of their responsibility in upholding high ethical standards.



A fifth-century BC marble relief possibly showing Hippocrates treating a woman

FIVE CURIOUS CURES FROM ANCIENT TIMES

▶ BLOODLETTING

This remained a common treatment for many ailments right up until the 19th century. Ancient physicians used bloodletting to help the body get rid of whichever humour was deemed to be out of balance. Either a vein would be cut, or leeches used to suck out the unwanted blood. Unsurprisingly, the side effects of bloodletting could include fainting or even death from blood loss.

◀ ANIMAL DUNG

With what we know about germs and bacteria today, animal excrement might not be the first item we'd reach for when ill, but the Ancient Egyptians swore by it. The Ebers papyrus, which dates to around 1550 BC, advocated its use for everything from a healing cure to a contraceptive. In ancient Iranian medicine, the dung of a female donkey, known as Anbarnasara, was pushed up the nostrils as a cure for nosebleeds.

▶ THE WANDERING WOMB

The womb was believed to exert extraordinary influence over female physiology; it could cause suffocation and even death if it got out of hand. One cure for a womb in trouble was fragrant smells around the groin, but another was marriage; sexual activity was thought to be very important for a woman's health, but it had to be legitimate.

◀ WILLOW

Both the Ancient Egyptians and Hippocratic medicine recommended the bark of the willow tree as a type of pain relief and antipyretic (a drug used to reduce or prevent fever) – centuries later, in 1763, a study by the Royal Society proved willow bark's effectiveness. The active agent in willow bark is salicin, which, in the 19th century, would form the basis of the discovery of aspirin (*see page 50*).

▶ BABYLONIAN SKULL CURE

Demons and punishments by the gods were thought to be the cause of illness for ancient Babylonians, so a supernatural remedy was needed. To aid with teeth grinding, the patient was told to sleep next to a human skull for a week as it was thought that the spirit of a dead relative might be trying to get in contact. Kissing and licking the skull was required to ensure that the spirit was exorcised.

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Hygiene-aware Romans built sewage systems and toilets, like these in Ostia

"Hippocrates ensured his patients were observed at least once a day"

◀ and then acting on what you saw. Hippocratic doctors emphasised bedside medicine. They visited patients often and carefully noted how the patient had slept, excretions, mood, and whether they were feverish. Hippocratic teachings aimed to add rationality to medicine and separate the discipline from religion.

The Hippocratic tradition also took environmental factors into consideration, such as how changes in the weather could affect the body. Yet even Hippocrates didn't completely dismiss the idea of supernatural intervention. "He didn't tell people not to perform religious healing", says Fissell. "He just argued that naturalistic explanations should be used in relation to illness. And that's the basis of Western medicine."

Many Hippocratic ideas were adopted by the Romans, and some of the Empire's top physicians were themselves Greek. The Romans made great leaps in hygiene and public health, showing an understanding of the need to keep clean. This is evident in the ingenious water supply systems they constructed, with aqueducts to carry clean water into towns.

The intensity of Roman warfare saw developments in battlefield surgery, too, and they developed a variety of surgical instruments, such as scalpels and bone levers. Each Roman legion had its own medical personnel, capable and willing to learn more sophisticated methods from the peoples that they conquered.

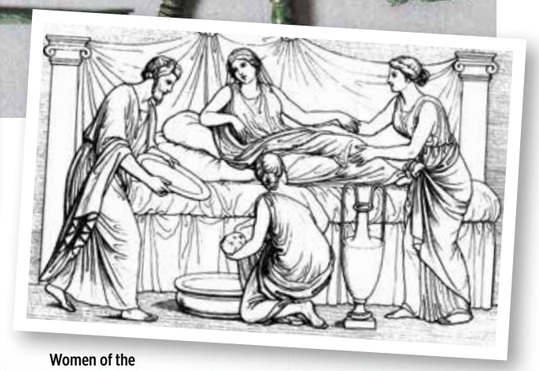
As Christianity spread through the West, this, too, changed the way that sickness was understood and charitable caring for the sick – an important part of Christian belief – saw the creation of hospitals for those unable to afford medical care.

Ancient midwifery was an occupation mainly reserved for women, and the training of midwives is mentioned in the Hippocratic texts. However, there is not much information about what midwives did or exactly who they were. On a local level, it is likely that specific women would be recognised as a person to call when a baby was on its way, and there would be those who had special knowledge of herbs and remedies. The word 'caesarian' refers to the myth that Roman emperor Julius Caesar was born using this procedure, but it is unlikely to have been performed in the ancient world.

Among the preserved treasures found at Pompeii is a collection of around 40 surgical tools

CUTTING EDGE
Much like today, Roman scalpels came in various sizes. Many of these instruments were similar to those used well into the 19th century.

STAY SHARP
Among the bronze and steel surgical instruments unearthed at Pompeii is this pair of scissors. Ensuring an edge sharp enough for surgery was difficult so they were more often used to cut hair.



Women of the ancient world had few vocations open to them, except for midwifery and healing

DOCTOR OR QUACK?

No qualifications were needed to practise as a physician, and the profession was not regulated. In the fifth century BC an Oath was written – now known as the Hippocratic Oath – which saw practitioners swear by Apollo, Hygieia, Asclepius and Panacea to respect their teacher and not to administer poison, abuse patients, use a knife or break the confidentiality between patient and doctor. In reality, it's unclear how much weight the Oath actually carried or how widely it was used in its time. Nevertheless, it exists in various forms today as part of many medical graduation ceremonies.

MEDICINE IN MEDIEVAL TIMES

The Catholic church had a profound influence on the care of patients during the Middle Ages – but the West was also turning to the Islamic world for inspiration

WORDS: EMMA SLATTERY WILLIAMS

The fall of the Roman Empire ushered in the medieval period in Europe, a period which saw plagues ravage and people were helpless to stop the spread of disease, with many eking out a harsh and uncomfortable existence under feudal systems.

Some historians have traditionally referred to the early medieval period as the 'Dark Ages' – although there is a movement to change this way of thinking. In terms of medicine, though, surviving source material is scant and there isn't a great deal of evidence to suggest that medicine evolved much beyond the teachings of the ancient Roman and Greek empires. Indeed, according to Professor Mary Fissell, early medieval medicine was "frankly not super-sophisticated".

Early medieval medicine often focused on herbal remedies and charms, and the works of ancient physicians – in particular that of Hippocrates and Galen – were still closely followed and taken to be accurate, but as human dissection had been banned in the Roman Empire, Galen had based most of his scientific findings on the anatomy of animals. It wouldn't be until the early 16th century that human dissection would be fully utilised as a way of learning about the body – and even then, it was sometimes seen as controversial.

> "It was logical for people to believe that God had decided to make them ill in the first place"

Another key factor behind the lack of progress in medieval Europe was down to the simple problem of disseminating material. The printing press wouldn't be developed by Johannes Gutenberg until the 15th century, so scientific ideas were slow to spread, and texts were written by hand. What's more, the majority of the population was illiterate – members of the clergy and nobility were often the only people who could read.

To some extent, medicine in medieval Europe operated within the confines of the Church, with healthcare provided by monasteries. In the High Middle Ages, hospitals caring for the sick and infirm were founded, run by religious orders.

ABOVE: **An image depicting the Schola Medica Salernitana, a centre for medical learning in the 9th and 10th centuries**
RIGHT: **Christ shown alongside men representing the four temperaments associated with the 'four humours' (melancholic, sanguine, phlegmatic, choleric), 1486**

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ABOVE: **A 13th-century fresco depicts antiquity's two biggest medical giants: Galen (*left*) and Hippocrates (*right*)**
RIGHT: **Bloodletting was a common practice, as seen in this c1350 image**

People used relics, prayed to saints to intercede for them to cure illness or speed delivery, and went on pilgrimages to holy sites – an early form of medical tourism.

In the 10th century, Salerno emerged as a site of medical learning, a place where Greek Arabic, and Latin learning intersected. In the 12th century, universities began to be founded all across Europe. At first they trained clerics, but quickly expanded to law and medicine. Learned physicians now studied Latin and women were excluded from such training.

LOOKING EAST

So, what were your options if you were ill in the medieval world? While there were physicians you could visit if you had the money, most ordinary people relied on local healers and apothecaries with knowledge of herbs and plants. But when it came to what was actually *making* you ill, a variety of different causes were blamed. Many believed that living a sin-free, godly life was key to good health, while others blamed planetary alignments or witchcraft for their maladies.

Bad-smelling air – 'miasma' – was a common theory as to causes of disease. During plague outbreaks, some efforts were made to keep towns cleaner, and although this didn't provide a cure, it certainly helped keep citizens in better health. Similarly, the concept of the 'four humours' was still important in medicine, just as it had been in antiquity. To this end, bloodletting and other ways of purging the body were practised as physicians sought methods to bring the humours back into balance.

Most of the more forward-thinking medical innovations of medieval Europe, however, were driven from the East, as Fissell explains: "Medicine in the Islamic world was actually a lot more sophisticated than that in Europe. During the 9th and 10th centuries, the Islamic world saw a growth in sophisticated hospitals, as well as developments in surgery. It was a really lively place intellectually."

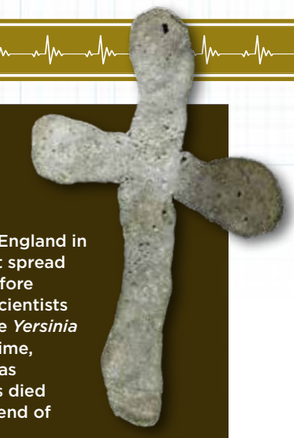
Over the course of the 11th and 12th centuries, many of these ideas were brought into western Europe, allowing access to previously unknown ideas: "There was an influx of new learning as medical texts were translated. Arab surgical techniques really kickstarted surgery as a more specialised kind of work."

Furthermore, the development of universities saw the beginnings of medical regulation, and the job of 'physician' evolved into a fully-fledged and licensed career: "Medicine, along with religion and law, became one of the three main faculties of these early universities", continues Fissell. "In some cities, the university's faculty of medicine would be granted power by the local government to regulate who got to practise. It's the first time we can see a division between who was trusted and qualified to practise medicine, and who was not."

Continues on p38

BLACK DEATH

Inside history's deadliest pandemic



A hastily made lead cross from the grave of a London monk killed by the Black Death

The Black Death arrived in England in around 1347/8 – having first spread through China and India before coming to Europe. Today, scientists believe it was caused by the *Yersinia pestis* bacteria, but at the time, people had no idea what was causing it and as thousands died around them, believed the end of the world was coming.

Bubonic plague, the most common form of plague, saw those infected come out in painful swellings (buboes) and suffer from fevers and headaches before death claimed them, usually within a few days. The disease spread from house to house and village to village, and soon, everyone knew someone who had been affected. Fissell says: "Plague came as a tremendous shock to medieval society. Medicine was basically powerless; people could do nothing."

Today it's thought that fleas carried the disease and spread it to humans, probably via rats who stole away on ships, spreading it from port to port. As many as 50 million people across Europe and up to 40 per cent of England's population are thought to have died from the Black Death; the disease would frequently reappear, especially in crowded cities, every few decades for centuries.

A range of reasons for plague were given: from foul-smelling air, to curses from witches. The finger was even pointed at Jewish communities, who were accused of poisoning wells. To the deeply religious medieval society, however, the most logical explanation was that plague had been sent as a punishment from God for their sins. Church services increased as people desperately prayed for forgiveness and an end to their suffering, while others went on pilgrimages to holy sites and monasteries.

Even the universe was looked to for answers, according to Fissell: "When the medical faculty in Paris was asked by the government to explain what was happening, they blamed poisonous air caused by a bad conjunction of the planets. Astrology was a big part of medical science during the medieval period."

Thousands of Jewish men and women were massacred during the Black Death, accused of spreading the disease by deliberately poisoning wells

DIAGNOSIS AND TREATMENT

Leeches, vipers and spiderwebs were what the doctor ordered

If you were unlucky enough to become unwell in the medieval period, there were a whole host of treatments available – albeit with varying results.

Although their scientific knowledge may have been limited, medieval physicians did understand that keeping active and healthy could prevent disease. Regular exercise was seen to be beneficial, and guides recommending it can be found as far back as the 14th century. To combat suspected disease in the air, pleasant-smelling herbs and flowers were recommended by apothecaries to keep away the miasma.

When attending a sick person, examination of the patient's urine was often a medieval physician's first port of call. Like modern medicine, medieval doctors understood that urine offered important clues about what was happening deep inside the body. While we focus on biochemistry, they saw evidence of the imbalance of the four humours in the various colours of urine.

As the theory of the four humours still reigned supreme, bloodletting was a common medical prescription. Doctors either used lancets to open a vein and let blood, or used leeches to bleed a patient a bit more gradually.

ABOVE: Some doctors believed medicine and astrology were intrinsically linked

LEFT: Physicians ponder over the course of treatment for a 16th-century patient

Charms and amulets were often used to ward off sickness and disease. The movements of the stars and planets were thought to influence everything on Earth, too – from the weather to the body. Physicians often consulted a diagram known as 'Zodiac Man' (*pictured above right*), which explained how astrological formations could interfere with the body and cause illness.

In terms of other remedies offered, medieval people used a wide array of herbal preparations. While some, such as theriac, an expensive preparation made from dozens of herbs and the flesh of vipers, would not win approval today, other medieval remedies had surprising virtues. Spider-webs, for example – which were occasionally used to treat wounds – have naturally occurring antiseptic and antifungal properties and could therefore stave off infection.

DID YOU KNOW?

STITCHED UP

Although women were banned from university and couldn't qualify as physicians, some did undertake apprenticeships and train as surgeons. However, when the medical professions were formalised in the 17th century, women were excluded.

SURGERY

From the barbershop to the battlefield, medieval operations could be tortuous – and pretty messy

Medieval surgeons were trained by guilds, which had strict rules about who could practise, rules that cities were happy to back up with prosecutions. Some surgery was performed by people known as 'barber surgeons', which means exactly what it sounds like: the man who cut your hair could also amputate your leg or pull out a tooth. This is where the colours on a barber's pole come from – the red and white representing blood and bandages.

Today, surgeons are known as 'Mr', 'Ms' or 'Mrs' rather than 'Dr' – a practice that goes all the way back to the Middle Ages. While doctors studied for several years at university (*see opposite page*), surgeons began their training as apprentices and were seen as being less educated.

Internal surgery was limited as it was impossible to perform without anaesthesia and asepsis, but surgeons could heal ulcers and wounds and sometimes even remove bladder stones. Cataract surgery, performed with a needle to remove the clouded lens, was painful but might restore sight to someone who had gone blind.

Anaesthetic wasn't a luxury medieval people had – the only option was to bite down on something to stop you gnawing your tongue and hope the pain would knock you out. Opium and herbs such as hemlock could make patients drowsy, but there was also the risk of putting people to sleep permanently.

The countless wars fought during the medieval period gave surgeons plenty of opportunities to hone their skills. During the battle of Shrewsbury in 1403, Prince Henry (later Henry V), was shot in the head with an arrow. John Bradmore, a skilled surgeon, devised a pair of forceps to remove the arrowhead, which was embedded in the prince's skull. He then covered the wound in honey and wine to prevent infection, later writing a thesis – *Philomena* – on his techniques.

Elsewhere, the Siege of Málaga, in 1487 saw basic ambulances first used, with wagons transporting wounded soldiers from the battlefield.

A barber surgeon gets to work on a soldier suffering from an arrow injury in an image dated c1517

GETTY IMAGES X4, WELLCOME COLLECTION X1

PUBLIC HEALTH

Towns became cleaner – but being a 'gong farmer' wasn't much fun

It's now widely thought that medieval English towns were often cleaner places to live than the industrial cities of the 19th century. The fear of plague (often believed to be caused by 'bad air') saw regular attempts to clean up urban areas, and in 1388, England's parliament passed its first law banning the disposal of waste and rubbish into rivers and other watercourses. A sure contender for one of the worst jobs in history was the medieval gong farmer, who removed human waste from public latrines and cesspits.

Many towns would have had public bath houses – though not as luxurious as their ancient Roman counterparts, they still helped keep people clean. Physicians believed that a good level of personal hygiene could ward off diseases, and some homes would have even had their own wooden bathing tubs.

Due to the reoccurrence of plague, moves were made to try and limit the spread of infection. In the 14th century, Venice began quarantining ships that arrived in its port. In total, sailors were forced to wait in the lagoon for 40 days (*quaranta giorni*) before being allowed to disembark, which is where our word "quarantine" comes from. Such quarantine laws were later adopted across Europe, on dry land as well as on ships. In mid 16th-century London, for example, plague-affected homes were put under quarantine and their doors marked with blue crosses.

"It was during times of plague that we see the advent of early public health measures", says Professor Mary Fissell, "especially in the Italian cities, where they start creating quarantines and boards of health that regulate them. These officials ensured that no bodies were left in the streets, because they had a theory that if something was left to decay outdoors, it would create bad air, which in turn was thought to cause disease. As the plague returned at various intervals throughout the medieval period, boards of health built temporary hospitals outside the cities. They tried to move towards isolation and containment in ways that they hadn't tried before."

Bath houses were the ideal place to get clean – although they were also associated with loose morals

BIG NUMBERS

Statistics from the world of medieval medicine

20-30%

of children died before their first birthday

30-35

The average life expectancy in the 1350s

7

The number of years a physician would train at university

HOSPITALS AND UNIVERSITIES

New institutions tended to the sick and helped train physicians

Hospitals assumed a new importance in the Middle Ages, as charitable and religious institutions, where those too old or ill to look after themselves could be cared for by monks and nuns. But those suffering from infectious diseases, such as leprosy, would often not be admitted.

St Bartholomew's Hospital in London was originally founded as part of the Priory of St Bartholomew's in 1123, and still exists today, making it the oldest continually operating hospital in England (that is still on the same site). Other hospitals were later established by local guilds and would only contain a few beds, while others were used for specific ailments such as leprosy.

Like today, physicians underwent formal medical training at university, but only the very wealthiest members of society could afford to attend them. Indeed, by 1300 there were only around 100 qualified physicians in England.

As part of their seven-year training, physicians would study the texts of renowned ancient scholars such as Hippocrates and Galen, as well as translations of works by Arab doctors such as Ibn Sina. Professors wrote commentaries on these older texts, updating or even questioning the knowledge in them.

But although medieval medicine may seem primitive to modern eyes, it did mark the start of physicians needing to be licensed in order to practise. Surgeons and apothecaries had their education and practice regulated by guilds, which examined practitioners to make sure they were up to scratch. ⊙

An 18th-century view of St Bartholomew's Hospital, London, originally founded as a part of an Augustinian priory in 1123

6 SURPRISING FACTS ABOUT THE HISTORY OF MEDICINE

How did people in the past treat illness, injury and disease? **Caroline Rance** shares a selection of remarkable case studies from around the globe – from the first general anaesthetic to early caesareans and medicinal leeches...

1 CATARACT SURGERY WAS POSSIBLE IN THE 6TH CENTURY BC

One of the oldest known medical textbooks is the *Sushruta Samhita*, written in Sanskrit in India. Its exact date is tentative, as no original version survives and it is only known from later copies, but the current consensus is that it was written in around 600 BC. Sushruta is thought to have been a physician and teacher working in the north Indian city of Benares (now Varanasi in the state of Uttar Pradesh). His *Samhita* – a compilation of knowledge – provides detailed information on medicine, surgery, pharmacology and patient management.

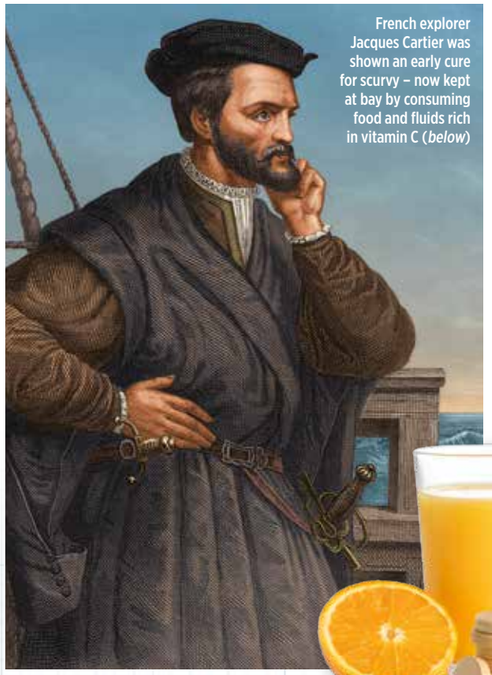
Sushruta advises his students that however well read they are, they are not competent to treat disease until they have practical experience. Incisions, he said, were to be tried out on the skin of fruits, while extracting fruit seeds enabled the student to develop the skill of removing foreign bodies from flesh. They also practised on dead animals and on leather bags filled with water, before being let loose on real patients.

Among its many surgical descriptions, the *Sushruta Samhita* documents cataract surgery. The patient had to look at the tip of his or her nose while the surgeon, holding the eyelids apart with thumb and index finger, used a needle-like instrument to pierce the eyeball from the side. It was then sprinkled with breast milk and the outside of the eye bathed with a herbal medication. The surgeon used the instrument to scrape out the clouded lens until the eye "assumed the glossiness of a resplendent cloudless sun".

During recovery it was important for the patient to avoiding coughing, sneezing, burping or anything else that might cause pressure in the eye. If the operation were a success, the patient would regain some useful vision, albeit unfocused.

An Indian man with cataracts in his eyes. The condition is still a major cause of blindness in many parts of the world today

Excerpts from a copy of the *Sushruta Samhita*, which details a primitive form of cataract surgery



French explorer Jacques Cartier was shown an early cure for scurvy – now kept at bay by consuming food and fluids rich in vitamin C (*below*)

2 A 'TREE OF LIFE' TACKLED SCURVY

Trapped in ice near Stadacona (the site of present-day Quebec City) in 1536, Jacques Cartier's ships weren't going anywhere. The crews, holed up in a makeshift fort with little access to fresh food, came down with a disease so gruesome that "their mouth became stincking, their gummes so rotten, that all the flesh did fall off, even to the rootes of the teeth, which did also almost all fall out". They had scurvy, now known to result from a deficiency of vitamin C. Cartier had no idea what to do.

During the course of his first voyage to Stadacona in 1534, Cartier had kidnapped two young men, Dom Agaya and Taignoagny, taking them back to France as proof that he had discovered a new territory. Now that they were home, the men and their community had every reason not to trust Cartier – an attitude that he interpreted as "treachery" and "knavery".

In spite of this tension, Dom Agaya showed Cartier how to make a decoction from a tree called "Annedda" and, although the Frenchmen wondered if it were a plot to poison them, a couple of them gave it a go and were cured within days. After that, there was such a rush for the medicine that "they were ready to kill one another", and used up a whole large tree.

The identity of Annedda is not certain but there are several candidates, including eastern white cedar and white spruce. Whatever it was, its nutritional benefits resulted in the sailors' complete cure.

Cartier repaid Dom Agaya by kidnapping him again along with nine others. By the time of Cartier's next voyage, most of the prisoners were dead, but Cartier informed their relatives that they were living in style in France. The scurvy cure did not gain widespread recognition and the disease continued to claim sailors' lives for another 200 years. ▶

GETTY IMAGES X4, ALAMY X2

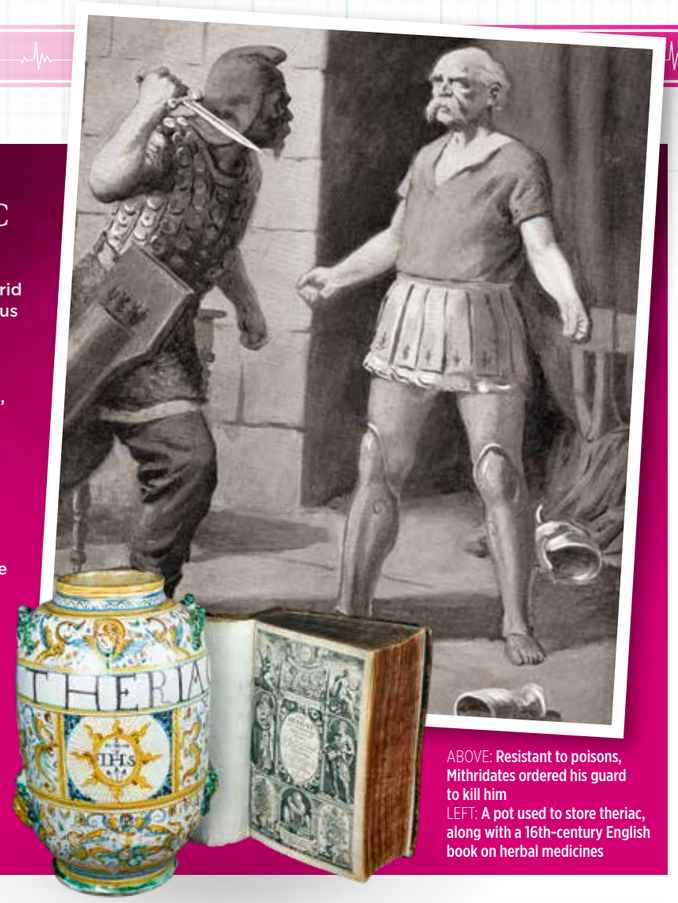
3 IF YOU WANT A CURE FOR EVERYTHING, TRY THERIAC

Being a king in ancient times was exhaustingly dangerous; there was always someone plotting to get rid of you. So, according to legend, Mithridates VI of Pontus (on the shores of the Black Sea in what is now Turkey) attempted to become resistant to poisons by taking gradually increasing doses. He was also reputed to have conducted experiments on condemned prisoners, culminating in the creation of mithridate – a medicine that combined all known antidotes in one formula.

It didn't work against Roman armies, however, and when Mithridates was defeated by the military leader Pompey in 66 BC, the recipe supposedly arrived in Rome. Emperor Nero's physician Andromachus developed it into a 64-ingredient composition, which became known as theriac. Most of the ingredients were botanical (including opium), but viper's flesh was a notable component.

In spite of early scepticism, theriac took off as a prized (and expensive) cure-all. By the 12th century Venice was the leading exporter and the substance had a high profile in European, Arabic and Chinese medicine alike. Its fortunes waned after 1745, however, when William Heberden debunked its alleged efficacy and suggested that enterprising Romans had exaggerated the Mithridates story for their own gain.

Even so, theriac remained in some European pharmacopoeias until the late 19th century.



ABOVE: Resistant to poisons, Mithridates ordered his guard to kill him
LEFT: A pot used to store theriac, along with a 16th-century English book on herbal medicines

4 GENERAL ANAESTHESIA WAS USED IN JAPAN DURING THE EARLY 1800s

Kan Aiya, a 60-year-old woman, had lost many loved ones to breast cancer. She had seen her sisters die of the cruel disease, so when a tumour formed in her left breast she was well aware of the likely outcome.

For her, however, there was fortunately a small chance of survival. It was 1804 and Kan Aiya was in the best possible place for surgery – feudal Japan.

Seishū Hanaoka (1760–1835) studied medicine in Kyoto and set up a practice in his hometown of Hirayama. He became interested in the idea of anaesthesia owing to stories that a third-century Chinese surgeon, Houa T'o, had developed a compound drug enabling patients to sleep through the pain. Hanaoka experimented with similar formulae and produced *Tsusensan*, a potent hot drink.

Among other botanical ingredients it contained the plants *Datura metel* (aka *Datura alba* or 'devil's trumpet'), *Angelica decursiva* and monkshood, all of which contain some potent physiologically active substances.

Tsusensan had quite a kick, and if you glugged it down willy-nilly you would probably die, but in the correct dosage it rendered patients unconscious for between six and 24 hours, allowing ample time for surgery.

On 13 October 1804, Hanaoka excised Kan Aiya's tumour after she had taken a dose of *Tsusensan*; he would go on to operate on at least 150 more breast cancer patients and people with other conditions. Sadly, Kan Aiya is thought to have died of her disease the following year, but had been spared the agony that still characterised surgery in the West.

Illustrations from a medical casebook by Seishū Hanaoka, who successfully operated on cancer patients using general anaesthesia

GETTY IMAGES X4, ALAMY X3

5 A 'LEECH CRAZE' HIT 19TH-CENTURY EUROPE

The medicinal leech has been in use for thousands of years, and is even today considered to be a way of restoring venous circulation after reconstructive surgery. But it was in the early 19th century that the leech really soared in popularity. Led by French physician François-Joseph-Victor Broussais (1772–1838) – who postulated that disease stemmed from irritation of the gastrointestinal tract that passes to other organs "sympathetically" and was treatable by bloodletting – the 'leech craze' saw barrels of the slippery creatures shipped across the globe, wild leech populations decimated almost to extinction, and the establishment of prosperous leech farms.

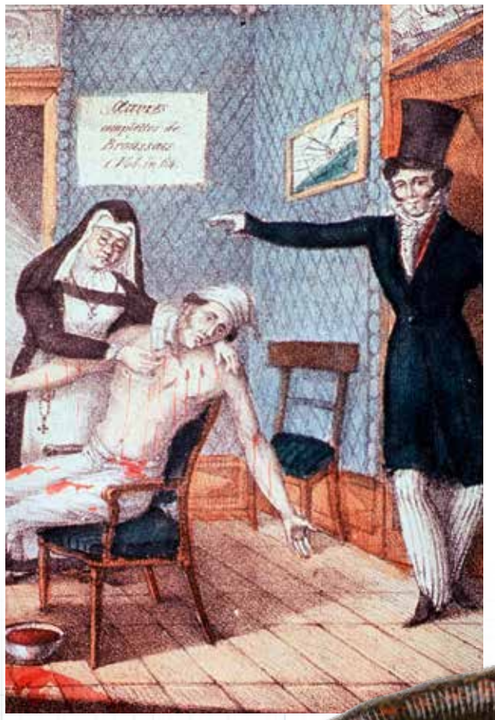
Leeches had advantages over the common practice of bloodletting using a lancet – the loss of blood was more gradual and less of a shock for those of delicate constitution. And because Broussais's followers used leeches in place of all the other medicines at the 19th-century physician's disposal, patients were spared some harsh remedies that might otherwise have made them feel worse.

In 1822, a British surgeon called Rees Price coined the term sangui-suction for leech therapy.

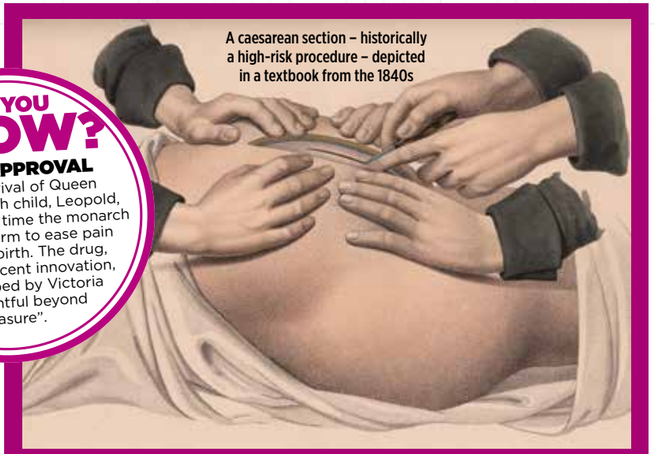
DID YOU KNOW?

ROYAL APPROVAL

The 1853 arrival of Queen Victoria's eighth child, Leopold, marked the first time the monarch used chloroform to ease pain during childbirth. The drug, a relatively recent innovation, was described by Victoria as "delightful beyond measure".



Leech pioneer François-Joseph-Victor Broussais (*above, wearing top hat*) helped popularise the use of these bloodthirsty creatures (*right*)



A caesarean section – historically a high-risk procedure – depicted in a textbook from the 1840s

6 UGANDAN SURGEONS DEVELOPED LIFE-SAVING CAESAREAN OPERATIONS

In 1884, the caesarean section was not a new idea. It dated from the time of the Caesars, when Roman law required the procedure to be carried out in the event of a woman's death in childbirth.

Over the centuries, reports occasionally surfaced of caesarean sections saving the lives of both mother and baby, but even after the introduction of antiseptic methods and anaesthesia, caesareans remained a dangerous last resort. So Edinburgh surgeons were surprised to hear a lecture by Robert Felkin, a missionary doctor, about a successful operation that he had witnessed in the African kingdom of Bunyoro Kitara in Western Uganda five years earlier.

The operation, Felkin reported, was carried out with the intention of saving both lives. The mother was partially anaesthetised with banana wine. The surgeon also used this wine to wash the surgical site and his own hands, suggesting awareness of the need for infection control measures.

He then made a vertical incision, going through the abdominal wall and part of the uterine wall, before further dividing the uterine wall enough to take the baby out. The operation also involved removing the placenta and squeezing the uterus to promote contraction.

The means of dressing the incision was also highly developed: the surgeon used seven polished iron spikes to bring the edges of the wound together, tying them in place with bark-cloth string. He then applied a thick layer of herbal paste and covered this with a warm banana leaf held in place with a bandage. According to Felkin's account, the mother and her baby were still doing well when he left the village 11 days later.

Although caesarean operations had been performed in Africa by white surgeons before this date, the procedure appeared to have been developed independently by the Banyoro people – a somewhat discomfiting realisation for a British audience familiar with colonial tales of 'savages'. ⊙

GET HOOKED

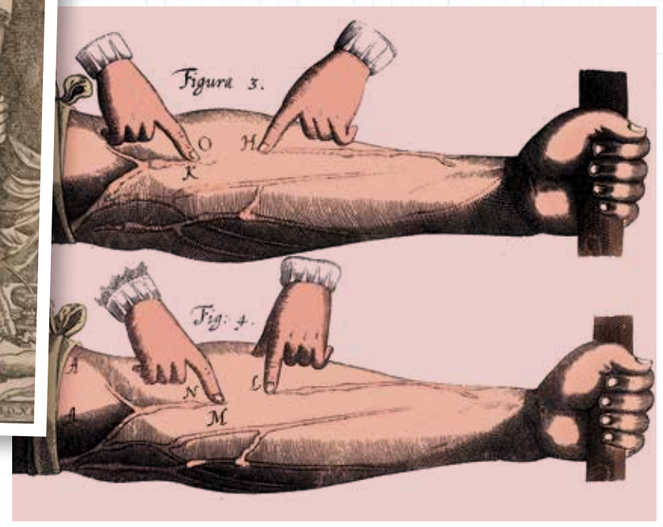
READ

Caroline Rance is an author and historian. Her books include *The Quack Doctor: Historical Remedies for All Your Ills* (The History Press, 2013) and *The History of Medicine in 100 Facts* (Amberley, 2015). Visit her website: *thequackdoctor.com*

A MEDICAL RENAISSANCE?

The end of the medieval period heralded an age of medical discovery, where physicians challenged accepted theories and explored new medical substances from around the world

WORDS: EMMA SLATTERY WILLIAMS



LEFT: **Andreas Vesalius's anatomical treatise *On the Fabric of the Human Body* changed the way people saw the body**

CENTRE: **With his many dissections, Vesalius challenged views going back to ancient times**

RIGHT: **A diagram from William Harvey's famous studies into the circulatory system, published in 1628**

The Renaissance, the Age of Enlightenment and scientific and technological revolutions: the early modern period, roughly defined as the late-15th to late-18th centuries, saw a shift away from medieval thinking. And the field of medicine was no different. Physicians questioned theories of ancient minds like Galen and Hippocrates, which had been the bedrock of Western medicine for millennia, and made new discoveries, practices and treatments.

This medical 'renaissance' led to new understanding of the circulation of the blood, anatomy, the causes and effects of disease and surgery to name a few. The treatment of battlefield wounds improved – constant wars and fighting throughout these centuries meant surgeons had plenty of opportunity to try new things and benefited from new studies of anatomy.

Nevertheless, life expectancy remained low and diseases, notably plague, were still rife. Conditions may, in fact, have been worse than the medieval era at times, due to the growth of cities, where sanitation was poor. Voyages of discovery brought new remedies to Europe but transported infectious diseases like smallpox to the New World, creating huge mortality in populations unfamiliar with these diseases.

New world plants like sarsaparilla and snakeroot were brought back to Europe and eager adopted. Tobacco, too, was brought from the New World to the Old, initially as a kind of cure-all for any number of ailments. Quickly it left medicine behind to become the recreational substance we know today.

The theory of the humours continued to shape learned medicine's approach to healing. Bloodletting and purges were the mainstays of therapy. Prayers and charms remained regular preventative measures to keep disease and death at bay, and some people turned to the monarch rather than medical professionals for healthcare.

The 'king's touch' was a much-vaunted ceremony in France and England, where it was believed that a monarch laying their hands on the sick would cure them of the 'king's evil', or scrofula (a form of tuberculosis that could go away on its own). Charles II of England is thought to have performed the touch on as many as 90,000 people. Ordinary folk who might not be able to afford a university-educated physician relied on domestic medicine. Many ailments get better on their own, and careful nursing at home helped many people survive episodes of illness.

> **"It was believed that a monarch laying their hands on the sick would cure them of scrofula"**

QUACKS AND QUESTIONING

Trained and trustworthy physicians were expensive so only the wealthy could benefit from their wisdom. Most people got medicine and medical advice at the apothecary's shop, or made their own medicines with herbs gathered locally or purchased at the market. However, new kinds of commercial practitioners also began vying for custom. They sold new and exciting remedies, already packaged up, sometimes with pamphlets of information for the users. Such practitioners were often labelled "quacks" by the learned physicians who did not like the competition; Britain did not pass comprehensive laws to control who could hand out medical advice until the mid-19th century.

At the same time as the so-called quacks, however, more people than ever were showing an interest in scientific understanding thanks to the advent of the printing press. This enabled medical texts to spread quickly across Europe. Professor Mary Fissell suggests that with access to more texts came the initiative to be more questioning. "Physicians began to get critical about what they were reading, and more sophisticated with it," she says. "For the first time, people were saying, 'This classical authority isn't quite right for where I am.'"

For centuries, dissecting the human body was viewed as a desecration. Although, Fissell points out that the idea the Catholic Church banned it was a myth: "It came from surgeons and anatomists wanting to portray themselves as heroic battlers against superstition. A pope decreed something in 1215, which has been misread again and again as the church being against dissection," she says. "The church didn't like surgeons sneaking into graveyards at night and digging up bodies. That was desecration, after all. The problem was with how they got the bodies, not with the practice of dissection itself."

Physicians became more curious and willing to study inside the human body ▶

A quack doctor extracts a patient's tooth in this 17th-century painting by Flemish artist, Theodoor Rombouts

GETTY IMAGES X7, ALAMY X1

PIONEERING MEDICAL MINDS

Four men whose innovations and discoveries changed our understanding of the human body

AMBROISE PARÉ

French medical pioneer Ambroise Paré (1510–90) began his career as an apprentice barber surgeon in Paris, before spending 15 years perfecting his techniques on Europe's battlefields. Wounds had traditionally been cauterised using oil, but Paré created his own mixture that worked much better. He also invented tied ligatures to stop bleeding during amputations, as well as new types of artificial limbs.

WILLIAM HARVEY

The studies of William Harvey (1578–1657) into the body's circulatory system was a gamechanger. The personal physician to James VI & I and his son Charles I, Harvey was the first to prove that the heart acts like a pump and circulates blood around the body. Until this point, the humoural theory model that the liver was responsible for producing and distributing blood had been universally accepted.

ANDREAS VESALIUS

Born in Brussels, Andreas Vesalius (1514–64) became a professor of surgery and anatomy at Padua University aged just 22. He insisted that his students should undertake human dissection so they could fully understand how the body works. His 1543 treatise *On the Fabric of the Human Body* included accurate anatomical drawings and showed that the ancient scholars of Greece and Rome were not infallible.

PARACELSUS

Swiss physician and alchemist Paracelsus (1493–1541) rejected the works of Galen, despising the ancient physician so much that he publicly burnt some of his books. Paracelsus claimed there were three basic substances: salt, sulphur, and mercury, disputing the theory of the four humours. He is best known for pioneering the use of chemicals in medicine. For this, he is sometimes referred to as the 'father of toxicology'.

CURIOUS HOME REMEDIES

Far from being helpful, some of the items found in an apothecary's medicine cabinet could often be a hindrance and even downright dangerous

POISON PILLS

Patients with syphilis were sometimes prescribed highly toxic amounts of mercury and arsenic. Despite the dangers, the practice didn't stop until the 20th century.

WITH THE HELP OF THE DEAD

Some doctors utilised dead bodies to help 'cure' the living. Epilepsy patients were given medicine made using skulls taken from burial grounds, while ground-up remains of ancient Egyptian mummies were sometimes administered to those with asthma and tuberculosis.

THE POWER OF THE DIVINE

It should come as no surprise that people looked to the heavens for solutions to their maladies. It was common to repeat Bible passages and rhymes to cure everything from bleeding to burns.

PUNGENT PINTS

Certain types of sickness were thought to be eased by ingesting cow dung, which was dried into a powder and added to beer.

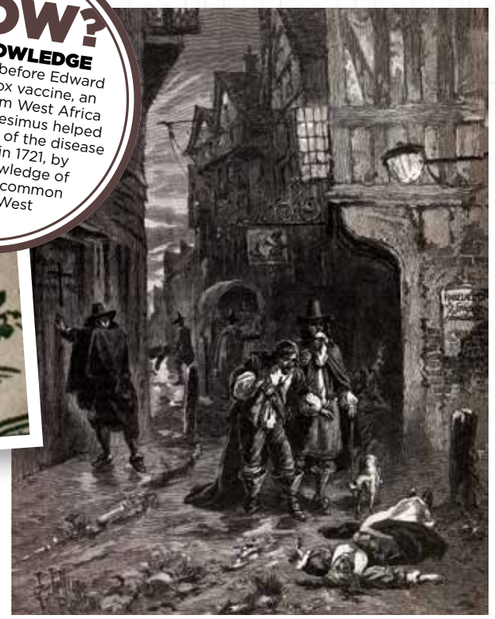
BOTTOMS UP!

If you suffered from bladder problems in the 17th century, one suggested remedy was wine mixed with garlic, crab eyes and the powdered penis of a stag.

DID YOU KNOW?

PRIOR KNOWLEDGE

Nearly 80 years before Edward Jenner's smallpox vaccine, an enslaved man from West Africa known only as Onesimus helped prevent the spread of the disease in Boston, US, in 1721, by sharing his knowledge of inoculation – a common practice in West Africa.



ABOVE LEFT: **A 17th-century engraving shows Londoners fleeing the Great Plague in the presence of the 'Angel of Death'**

ABOVE: **Plague victims' bodies could lay in the streets for days**

"The Great Plague ravaged London, killing 100,000 people, and the medical world was powerless"

◀ and, in 1543, the anatomist Andreas Vesalius published his epochal work, *De Humani Corporis Fabrica* ('On the Fabric of the Human Body'). He advocated the need for dissection and was able to prove that some long-held beliefs about the body – going back to the time of Galen – were wrong.

Another graduate of Padua University in Italy, William Harvey, made another anatomical breakthrough almost a century later by accurately describing the circulation of blood around the body by the heart. This disproved once and for all another aspect of Galenic medicine. Then, in 1761, another professor at Padua, Italian physician Giovanni Battista Morgagni, published *De sedibus et causis morborum per anatomen indagatis* ('The Seats and Causes of Diseases Investigated by Anatomy') containing more than 60 years of work on the causes of disease. By conducting post-mortem examinations, he developed the science of pathological anatomy.

In the 17th century, scientific and medical men began to investigate the unseen world by using the new invention of the microscope. The English polymath Robert Hooke published images of what he saw under the microscope, coining the word "cell" to describe the structure of cork. The Dutchman Antoine van Leeuwenhoek had used magnifying glasses to inspect the quality of fabrics he bought and sold, and then developed a new kind of microscope, seeing little wiggling "animalcules" (bacteria) and spermatozoa for the first time.

In the field of surgery, the French battlefield barber surgeon Ambroise Paré made innovations in treating wounds and invented instruments in the 16th century, earning him the nickname, 'the father of modern surgery'. He was a modest man who often claimed that "I bandaged him and God healed him".

CURING THE PLAGUE

For all the advancements, though, the early modern period continued to experience devastating mortality from the plague. From 1665 to 1666, the Great Plague ravaged London, killing an estimated 100,000 people, and the medical world was largely powerless to help.

The miasma theory led people to carry bottles of perfume, burn sweet-scented herbs in one's home, or light fires in the streets to purify the air. Continued belief in humoural theory meant that bloodletting was still being regularly prescribed to restore the balance of the fluids in the body. Other ways to ward off plague were to carry lucky charms, such as a hare's foot, or rubbing the plague sores with a live chicken. Houses were fumigated or, if those inside were already ill, closed off and marked with a cross.

As cities experiences waves of plague, they instituted increasingly effective quarantine measures, and not just for people. It was understood that clothing and fabric might also be a vector for the disease, so trading was also regulated to help diminish the risk of transmission.

Eventually such measures succeeded; the last epidemic of plague in Western Europe occurred in Marseille in 1720–21. Thousands died, but the epidemic did not spread to the rest of Europe; it was limited to the city and its environs. And it was the last European plague; quarantine worked.

While miasma, or bad air, continued to be blamed for outbreaks of plague, the nature of contagious diseases began to be explored. Syphilis arrived in Europe in 1495, in the midst of the siege of Naples, and it was immediately recognised as a brand-new disease. There was no point looking to Hippocrates or Galen; new medical knowledge had to be made. It was quickly recognised that the disease was sexually transmitted, although often women were blamed far more than men for its spread. New drugs like mercury and the New-World guaiac wood quickly became the remedies of choice for this new ailment.

Physicians may have failed to tackle the Great Plague effectively, but they did develop a greater understanding of contagions. "People began to see the way plague spread and reacted with quarantining measures," Fissell explains. "The advent of the French pox, what we call syphilis, was also understood as a sexually transmitted disease early on. In the early modern period, we begin to see more articulated ideas and practices, such as increasing development of quarantines or locking people in their house when they have the plague to prevent contagion." ⊙

GETTY IMAGES X11, ALAMY X2

HEALTHCARE IN 18TH-CENTURY BRITAIN

Surgery and care for the poor improved, while pioneering preventative treatments helped combat a killer disease

WORDS: EMMA SLATTERY WILLIAMS

By the late 18th century, Britain was seeing the beginnings of the Industrial Revolution, a process that eventually led to a huge migration of people to industrial cities, with widespread overcrowding and unsanitary living conditions. Drinking water was often contaminated with raw sewage, rubbish rotted in the streets, and crowded living conditions meant disease could easily spread. As many as one in five children died before their second birthday.

There was, however, growing institutional provision for curing the sick and the number of hospitals grew in 18th-century Britain – some of these were run by local parishes, while others were founded by philanthropists wishing to help the poor and perhaps improve their own social position in the process. In return for an annual contribution, a benefactor could recommend a sick person for admission to hospital. Fissell explains: "The notion was that you could intervene and save working class people who might otherwise die for lack of healthcare. It was part of a larger, almost mercantilist, view of the health of the population being a significant variable for government."

> **"We see a growth in the institutional provision of healthcare that simply hadn't been seen before"**

The 18th century also saw improvements in surgery. Surgeons such as William Cheselden, Percival Pott, and John Hunter delved into anatomical studies, diagnosing new diseases, and inventing new procedures. In 1745, the Company of Barber Surgeons was divided into two separate bodies by an act of Parliament. Thus, the Company of Surgeons was born, a body that formalised the training and licensing of surgeons and which today is known as the Royal College of Surgeons.

Dispensaries also began to be established – these provided what we might today class as outpatient medical treatment and advice, solely for the poor and free of charge. By 1800, about 40 dispensaries had been founded across Britain. Fissell explains: "In 18th-century Britain, we see a growth in the institutional provision of healthcare that simply hadn't been seen before. For the first time, working people who could never have afforded healthcare previously could now access it in a new way. We can also see something similar in the workhouse infirmaries of the Old Poor Law at this time."

LEFT: **In 1752, an act was passed in Britain allowing the bodies of murderers to be used for dissection, as shown in this engraving by William Hogarth**

ABOVE: **A recreation of an 18th-century pharmacy**

GETTY IMAGES X4, ALAMY X1

DID YOU KNOW?

HOLY COW!

The word 'vaccination' comes from the Latin for cow – vacca – in honour of Edward Jenner and his method of using cowpox to make his world-changing discovery to prevent people catching smallpox.

It is this preventative rather than reactive approach to healthcare that remains a legacy of 18th-century medicine, Fissell continues. "I see this as part of an enlightened turn towards the belief that things could be made better. It was a realisation that it was possible to prevent people from dying of disease and illness, and that's really radical."

One of the deadly diseases that was rife in the early 18th century was smallpox, characterised by its distinctive, progressive skin rash; outbreaks killed millions of people all over the globe. In 1715, Lady Mary Wortley Montagu – one of the most celebrated aristocratic women of the time – caught smallpox but survived, although the disease left her scarred. Her brother William had died from the disease in 1713, aged just 20.

The following year, Lady Mary and her husband, Britain's new ambassador to the Ottoman Empire, moved to Constantinople. There, Lady Mary discovered the widespread use of variolation (inoculation) – individuals were deliberately infected with smallpox (often by blowing dried smallpox scabs into the nose) after which they contracted a mild form of the disease. After recovering, the individual would usually be immune to smallpox – some estimates state that 1–2 per cent of those inoculated died, compared to 30 per cent who died after contracting the disease naturally.

LEFT: **Scottish doctor James Lind cured scurvy in his crew with citrus fruits in the 1740s; it would be decades before the Admiralty prescribed lemon juice to sailors**

RIGHT: **As well as introducing inoculation to Britain, Lady Mary Wortley Montagu was also an acclaimed writer and poet**

Lady Mary's children were inoculated and once back in England, in 1721, she publicised the benefits, facing resistance and scepticism. Undaunted, Lady Mary convinced Caroline, then Princess of Wales, of the value of inoculation and it was tested on prisoners, all of whom survived. Physicians began to inoculate their patients, but devised elaborate and costly procedures to make sure the body was prepared, ensuring that only the well-to-do were protected. By the late 18th century, mass inoculations with no preparation were on offer, and ultimately Lady Mary's efforts paved the way for the work of Edward Jenner (*see box below*).

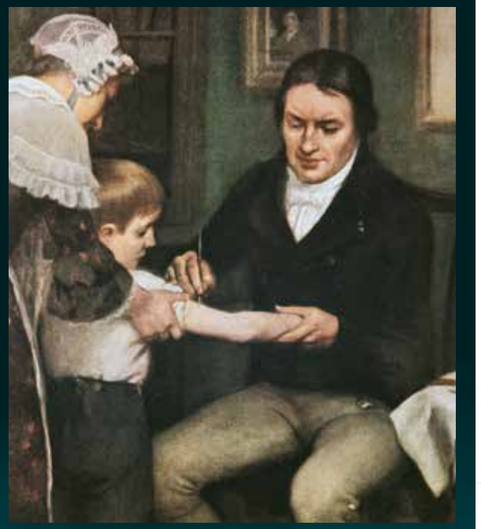
EDWARD JENNER AND VACCINATION

Jenner used local knowledge to develop a life-saving protection against smallpox

As a child, Edward Jenner (1749-1823) was inoculated against smallpox – thanks to the work of Lady Mary Wortley Montagu (*see above*) and at 14 was apprenticed as a surgeon. In 1770, Jenner moved to London to train under renowned surgeon John Hunter before returning home to Gloucestershire and becoming a local practitioner.

Growing up in the country, Jenner was aware of an old wives' tale that said people who caught cowpox – a mild infection caught from cows – never caught smallpox. Inoculation, which Jenner carried out on his patients, still posed a risk, so he began to research alternatives. In 1796, Jenner inoculated eight-year-old James Phipps with pus from a cowpox sore; a few weeks later, he infected him with matter from smallpox pustules, but Phipps never went on to develop the disease. The following year, Jenner submitted his findings to the Royal Society but his ideas were rejected as too radical. After experimenting on other children, including his own infant son, Jenner published his findings in 1798.

Although Jenner's methods were initially ridiculed and even criticised, and his initial tests would be considered unethical today, it soon became hard for anyone to deny the obvious protection vaccination offered. Nearly 200 years later, in 1980, smallpox was declared officially eradicated by the World Health Organization.



Dr Edward Jenner shown performing his first vaccination against smallpox on eight-year-old James Phipps

VICTORIAN MEDICINE

The 19th century paved the way for many of the modern medical practices that continue to benefit us today

WORDS: CHARLOTTE HODGMAN

The 19th century was a period of rapid technological change, and huge shifts in scientific understanding. As medical knowledge increased, the prospect of surgery was no longer a likely death sentence, and great leaps were made in medical procedures, equipment and knowledge of how the body worked.

By the 1860s what would become known as cell theory was widely accepted: that all living organisms are composed of one or more cells; that the cell is the basic unit of structure and organisation in organisms and that cells are created from pre-existing cells. New methods in cell staining and the development of technology, such as the microscope, also played crucial roles in furthering biological breakthroughs and aiding new research.

One of the most important medical breakthroughs of the 19th century was French chemist Louis Pasteur's discovery that germs cause disease, following on from Italian bacteriologist Agostino Bassi's work on silkworm infections. Pasteur's work with pasteurisation and his subsequent breakthroughs with inoculations against anthrax and rabies in turn inspired men like Robert Koch, who, in the early 1880s, identified the microorganisms that cause tuberculosis and cholera and created standards for researching the links between germs and disease.

"Having the ability to separate different bacteria and identify them for the first time was a huge medical breakthrough," says Professor Mary Fissell. "Being able to associate a specific germ with a specific disease and form a clear relationship between the two ushered in a completely new way of thinking about the body and ill health. There wasn't an immediate therapeutic payoff to the discovery, but it wasn't long before scientists started to figure out that antitoxins could be created to cure specific diseases.

"The first antitoxin, for diphtheria, was developed in the early 1890s and its impact was incredibly dramatic. I've always loved the fact that, in Britain, the diphtheria antitoxin was held in police stations because they could be accessed all night."

French chemist Louis Pasteur, pictured in 1885, successfully proved that germs could cause disease

Emil von Behring (*right*) won the first Nobel prize for medicine for his life-saving work on diphtheria

INTERNAL OPERATIONS

Prior to the 19th century, surgery had largely been performed outside the body – the only real operative surgery undertaken was the removal of bladder stones, a procedure performed without anaesthetic and usually completed in under two minutes to avoid the patient dying of shock and pain. In 1658, prolific diarist Samuel Pepys had a bladder stone allegedly the size of a tennis ball removed without pain relief – historians have suggested Pepys may have survived the procedure because he had been first on the surgeon's list that morning and had therefore been operated on with clean tools and hands!

"Police stations held the diphtheria antitoxin because they could be accessed all night"

"The advent of anaesthesia and antiseptic surgery was a real game changer, and surgery as we know it today was really invented in the late 19th century", comments Fissell. "As germ theory developed, people began to conceptualise what that might mean in terms of surgery. Initially, antiseptic surgery saw mists of carbolic acid continually sprayed in operating rooms during medical procedures in order to kill bacteria in the air, and wounds were packed and covered with lint and gauze soaked in carbolic acid. But by the 1880s, aseptic practices were being developed, eventually including steam sterilisation of instruments, rubber gloves, and the wearing of surgical gowns."

Continues on p52

9 MEDICAL BREAKTHROUGHS

From X-rays to new wonder drugs, the 19th century saw seismic change

STETHOSCOPE

In 1816, French physician René Laënnec observed two children signalling to each other via a piece of wood and a pin – one child had their ear to the wood and was receiving the amplified sound of a pin being scratched at the opposite end. Laënnec was inspired by this acoustic phenomenon to invent the stethoscope, with which the sounds made by the heart and lungs could be heard more clearly.

QUININE

In 1820, French scientists Pierre Pelletier and Joseph-Bienaimé Caventou discovered the process to extract and isolate quinine from the bark of the Cinchona tree, which had been used in powdered form to treat malaria since the 17th century.

ASPIRIN

In 1897, German chemist Felix Hoffman successfully combined acetylating salicylic acid with acetic anhydride, creating acetylsalicylic acid, a substance that could relieve fever, pain, and inflammation without upsetting a patient's stomach.

CHLOROFORM

In 1847, James Young Simpson, professor of midwifery at the University of Edinburgh (*below*), became the first physician to demonstrate the anaesthetic properties of chloroform on humans. He went on to pioneer its application in surgery and obstetrics.

ANTISEPTIC

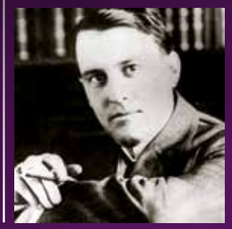
Using the work of men like Louis Pasteur and Ignaz Semmelweis (the latter who proved that doctors were responsible for transmitting childbed fevers in hospitals), Joseph Lister developed a carbolic acid spray for use during surgery. The death rate from infection after surgery decreased significantly as a result, although it was later realised that carbolic acid damaged tissues in the body.

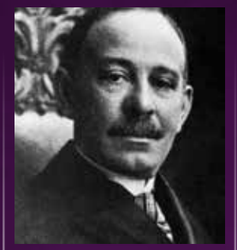
X-RAYS

In 1895, German physicist Wilhelm Röntgen accidentally discovered X-rays while testing whether cathode rays could pass through glass. Soon, doctors in Europe and the US were using X-rays to locate gun shots, bone fractures, swallowed items and kidney stones.

ELECTRIC HEARING AID

The first portable electric hearing aid was patented in 1895 by electrical engineer Miller Reese Hutchison (*below*). Known as the Akouphone, it used a carbon transmitter and electrical current to amplify weak audio signals.





HEART SURGERY

In 1893, African-American general surgeon Daniel Hale Williams (*above*) performed the first successful documented heart surgery on a young black man, James Cornish, who had been stabbed in his chest. Cornish survived and was discharged 51 days later.

OPHTHALMOSCOPE

The German physiologist Hermann von Helmholtz is generally considered to have invented the ophthalmoscope, in 1851, although English mathematician and inventor Charles Babbage is also a contender. The device revolutionised ophthalmology, allowing physicians to examine the inside of the human eye.

GETTY IMAGES X11

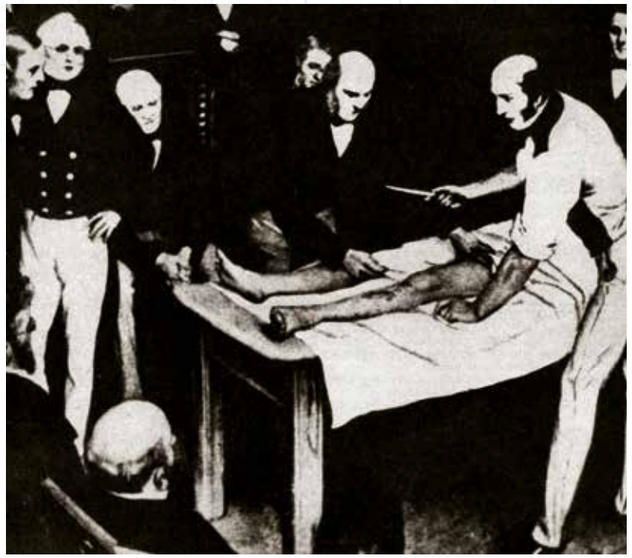
THE GREATEST SHOWMAN?

Scottish surgeon Robert Liston was always keen to demonstrate his knife skills

In the early 19th century, surgeons became minor celebrities as they vied with each other to operate on conscious patients – before anaesthesia – in the quickest time.

One of era's most famous surgeon-showmen was Scotsman Robert Liston whose speed at amputation (just 30 seconds in some cases) was widely celebrated. On one occasion, Liston's enthusiasm saw him amputate a patient's testicles as well as their leg, while on another occasion, his knife accidentally amputated his assistant's fingers in addition to his patient's limb – both the assistant and the patient later died of infection.

Nevertheless, Liston, who, unusually for pre-germ theory times, always removed his frock coat before operating, performed 66 amputations between 1835 and 1840, of which 'only' 10 died (1 in 6 patients). Elsewhere, at nearby St Bartholomew's Hospital, one in four patients ended up in the mortuary.



Surgeon Robert Liston (*right*) was renowned for his remarkable speed at the operating table

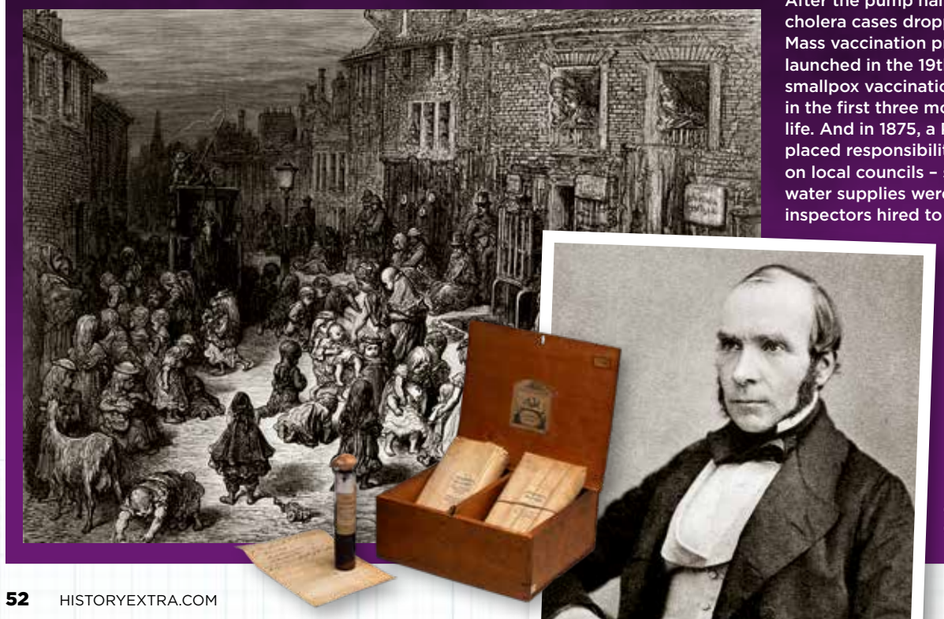
A POOR STATE OF HEALTH

Britain's filthy and overcrowded cities caused cholera chaos

Between 1801 and 1841, Britain witnessed a population explosion: the number of people living in London doubled, and in Leeds, the number nearly tripled. Many cities' housing and sanitation systems struggled to cope, and people were forced to live in appalling conditions: disease was rife.

Cholera – a bacterial infection caused by contaminated food or water – first arrived in Britain in 1831 and thrived in crowded, industrial towns. A cholera epidemic in 1831–32 claimed more than 50,000 lives across Britain, followed by another in 1848-9 – during which a Board of Health was set up, with the power to clean streets and build sewers. But with the prevailing theory in the first half of the 19th century being that disease was spread via bad air, more than 20,000 people died in a cholera outbreak in 1854.

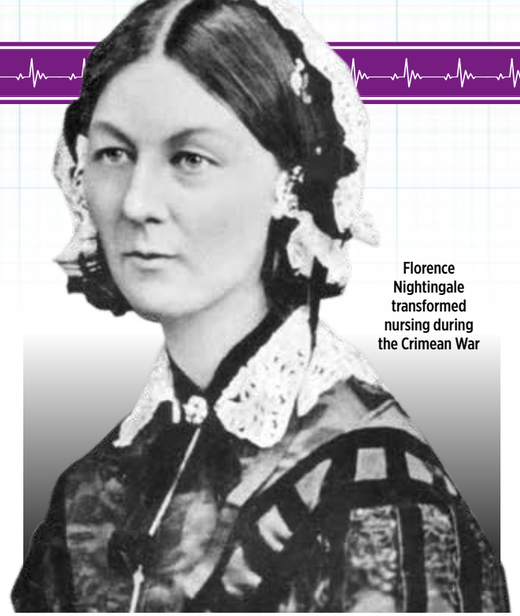
It was during this third epidemic that Dr John Snow made the connection between contaminated water and cholera – he plotted cases in the Soho area of London and identified a specific water pump as a source of contagion. After the pump handle was removed, cholera cases dropped dramatically. Mass vaccination programmes also launched in the 19th century – in 1853, smallpox vaccination became mandatory in the first three months of an infant's life. And in 1875, a Public Health Act placed responsibility for public health on local councils – streets, sewers and water supplies were to be kept clean and inspectors hired to enforce the laws.



MAIN: Many city-dwellers lived in cramped, unhygienic conditions, as this 1872 illustration of London's Seven Dials district shows

INSET: A wooden chest containing cholera medication, alongside a photograph of Dr John Snow – famous for connecting the spread of the disease to contaminated water

GETTY IMAGES X10, ALAMY X3



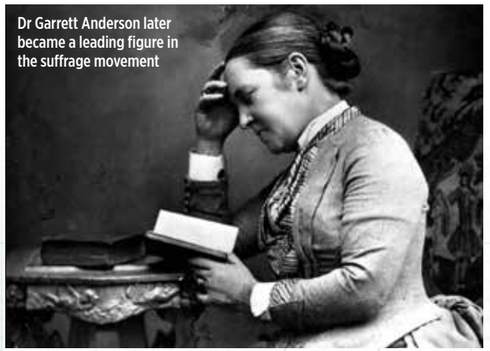
Florence Nightingale transformed nursing during the Crimean War

TRUE TRAILBLAZERS

Florence Nightingale and Elizabeth Garrett Anderson both made marks in a man's world

The foundations of modern nursing and the nursing profession itself were laid in the 19th century, and both owe a great deal to individuals such as Florence Nightingale (*above*), whose experiences as a nurse during the Crimean War revolutionised nursing practices. Arriving in Scutari, the British base hospital near Constantinople in November 1854, Nightingale and her team of nurses were greeted by horrific conditions: rodents and bugs; patients lying in their own excrement; contaminated water and lack of basic medical supplies.

Prioritising cleanliness and fresh air, Nightingale's tireless work saw the death rate in Scutari fall from 43 per cent to 2 per cent and the establishment of a Royal Commission for the Health of the Army, in 1857. News of her work spread and by 1900 there were 64,000 trained British nurses, with Nightingale herself founding a Training School for Nurses in 1860. In 1876, women were permitted to enter the medical profession with Elizabeth Garrett Anderson (*below*) becoming the first Englishwoman to qualify as a doctor.



Dr Garrett Anderson later became a leading figure in the suffrage movement

DID YOU KNOW?

A DUTY OF CARE

Another notable figure of the Crimean War was Jamaica-born Mary Seacole, who used her own money to establish the British Hotel – a place of respite for sick and recovering soldiers – near Balaclava. Her work and compassion saw her dubbed "Mother Seacole".

BIG NUMBERS

Vital statistics from the world of Victorian medicine

8

In 1853, Queen Victoria was anaesthetised with chloroform for the birth of her eighth child

22,698

The number of physicians and surgeons in England and Wales in 1901 (including 212 women)

140

The number of female dentists in England and Wales in 1901, out of a total of 5,309

52

The average age of a wealthy person living in the countryside in 1842

15

The average age of death for a labourer living in Liverpool in 1842

7.6

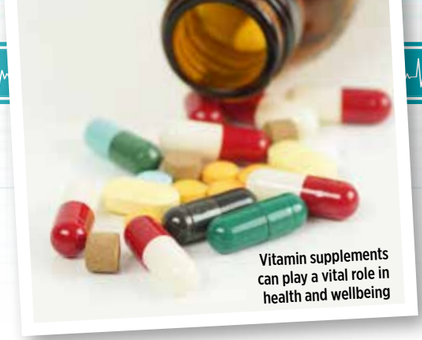
The number of inhabitants per house in Scotland in 1861. The introduction of 50 new statutes on housing saw the number drop to 4.7 by 1901

30

The length of time, in seconds, it reportedly took Scottish surgeon Robert Liston to amputate a leg

10 GIANT LEAPS IN 20TH-CENTURY MEDICINE

The 20th century arguably witnessed more seismic medical breakthroughs than any other period of history. A deeper understanding of science allied to a growing number of technological advances helped to eradicate certain diseases, and limit the spread of others, resulting in vastly improved life expectancy across the world compared to a hundred years earlier. **WORDS: NIGE TASSELL**



Vitamin supplements can play a vital role in health and wellbeing

1 KARL LANDSTEINER IDENTIFIES DIFFERENT BLOOD GROUPS

Dr Karl Landsteiner, pictured hard at work at his microscope in 1930

At the turn of the century, the Austrian biologist Karl Landsteiner identified the existence of three different blood groups within humans, A, B and O (although he called the latter C). This fuelled his subsequent discovery that combining blood from different groups resulted in blood cells being destroyed, while transfusing the blood of two people of the same blood group did not. With his sound science underpinning it, the practice of blood transfusions was established, leading to millions of lives being saved in the 120 years since Landsteiner's discovery. For his breakthrough work, he was awarded the Nobel Prize in Physiology or Medicine in 1930.

2 FLOREY AND CHAIN DEVELOP PENICILLIN INTO A USABLE DRUG

A bottle of penicillin culture from c1943. The wonder-mold has saved hundreds of millions of lives

Alexander Fleming is rightfully celebrated for his discovery of penicillin in his laboratory in St Mary's Hospital, London, in 1928. But it was two other scientists – an Australian pathologist and a German-born biochemist – who carried out the first clinical trials of penicillin 13 years later, before successfully creating a usable antibiotic drug out of Fleming's pioneering work. Howard Florey and Ernst Chain's collaborative breakthrough was a major boon to world health and is believed to have saved in excess of 200 million lives. Florey later admitted that creating a medicine was a fortuitous by-product: "I don't think it ever crossed our minds about suffering humanity. This was an interesting scientific exercise."

3 CRICK AND WATSON DISCOVER THE MOLECULAR STRUCTURE OF DNA

Francis Crick and James Watson formed one of the 20th century's most notable scientific partnerships. In 1951, the two biophysicists – one English, one American – joined forces at the Cavendish Laboratory at the University of Cambridge and, over the next couple of years, they discovered the structure of DNA; how it carries genetic codes in order to replicate itself. They built on the work of two London-based scientists – Maurice Wilkins and Rosalind Franklin – and, in 1962, Crick, Watson and Wilkins shared the Nobel Prize in Medicine for this breakthrough, which revolutionised molecular biology. Franklin, who had died in 1958 at the age of 37, couldn't be awarded the prize posthumously.

Rosalind Franklin was never recognised in her lifetime for her critical work with DNA

GETTY IMAGES X11

4 THE FIRST USE OF CHEMOTHERAPY IN TREATING CANCER

Goodman and Gilman's nitrogen mustard compound being injected

In the early 1940s, two doctors based at Yale University, Louis S Goodman and Alfred Gilman, were assigned to the US Army to study the effects of nitrogen mustard – a derivative of mustard gas, the chemical weapon used extensively during World War I. Studying 25-year-old medical records, the pair observed that many casualties exposed to mustard gas had a low count of white blood cells and speculated that if mustard gas could kill off white blood cells, it could do the same to cancerous ones. In 1942, they treated a 48-year-old gravely ill cancer patient with nitrogen mustard, euphemistically calling it a "synthetic lymphocidal chemical". After a number of treatments, the patient's condition noticeably improved. The experiment was the foundation stone of chemotherapy.

5 THE IMPORTANCE OF VITAMINS IS RECOGNISED

There is no 'eureka!' moment in the history of vitamins. No one breakthrough dominates this field of study as the emergence of their importance has been a slow trail of smaller discoveries by a wide cast of eminent scientists, among them Umetaro Suzuki, Sir Frederick Gowland Hopkins, Christiaan Eijkman and Casimir Funk. Among the significant milestones on this drawn-out journey was the realisation that certain diseases – such as rickets, pellagra and scurvy – weren't caused by infections, but a deficiency in particular vitamins. This led, from around 1910 onwards, to chemists identifying vitamins, calculating their chemical make-up, and developing ways to create and manufacture synthetic vitamin supplements. This in turn led to a reduction, and even eradication, of diseases during the 20th century and beyond.

6 INSULIN DEVELOPED TO TREAT DIABETES

Samples of insulin from shortly after the Nobel prize-winning discovery

On 11 January 1922, a team of scientists – Canadian physician Frederick Banting, his biochemist compatriot James Collip and an American-Canadian lab assistant Charles Best, under the directorship of Scottish biochemist John Macleod – administered the first-ever injection of insulin. Insulin is a hormone produced by the pancreas that regulates the level of glucose in the blood. As many diabetics are unable to produce insulin in necessary amounts (if at all), there was a need for artificially administered doses to balance blood sugar levels. That first injection, given to a gravely sick 14-year-old boy called Leonard Thompson, caused an allergic reaction due to the impurity of the dose, but a second nearly a fortnight later removed the excess glucose from the teenager's blood.

7 THE AVAILABILITY OF THE PILL

A tablet so ubiquitous and revolutionary that it's still known simply as 'the Pill', this oral contraceptive has allowed millions of women to separate sexuality and childbearing. US activist Margaret Sanger was the Pill's driving force. As the founder of the American Birth Control League, her lobbying helped fund the work of endocrinologist Gregory Pincus, with the US Food and Drug Administration approving it in 1960. The following year, the UK's Minister for Health, Enoch Powell, announced that the Pill could be prescribed on the NHS, but initially only to married women. It wasn't until 1974 that it was made available to all women.

The Pill was a milestone moment in the fight for women's reproductive rights

8 THE EMERGENCE OF LIFE-SAVING VACCINES

The race to produce effective vaccines to protect people against Covid-19 has been only the latest attempt to immunise before illness strikes. While Edward Jenner is largely regarded as the person who conceptualised the idea of vaccination with his smallpox vaccine in 1796, it was during the 20th century that the development of worldwide vaccination truly kicked in. Some of the most notable ailments for which vaccines were found include tuberculosis (a vaccine for which was first administered in 1921), diphtheria (1923), yellow fever (1938), polio (1950s) and the combined measles/mumps/rubella (1971).

Tens of thousands of polio vaccines are boxed up at Eli Lilly and Company plant

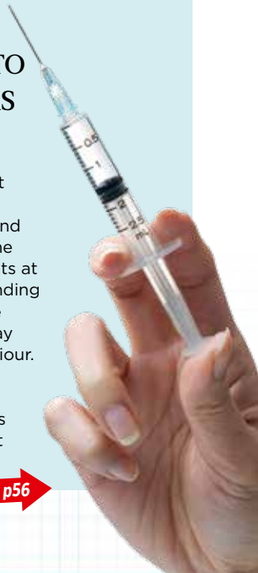
9 THE PIONEERING USE OF X-RAYS

An early form of X-ray machine was the fluoroscope, but was highly dangerous

X-radiation was discovered in 1895 by German scientist Wilhelm Röntgen who recognised its potential application in diagnosing fractures. But its widespread use in medicine was comparatively limited until the modern hospital, with a dedicated radiology department, revolutionised healthcare. Not that this stopped some enterprising individuals making good use of the technology. Among these was Polish-born French physicist Marie Curie, who invented a 'radiological car', which in 1914 she took to the battlefields of World War I. The vehicle carried an X-ray machine and photographic darkroom equipment, allowing army surgeons to make diagnoses of wounded troops.

10 THE INVENTION OF CHLORPROMAZINE TO EASE PSYCHOTIC DISORDERS

Until the drug chlorpromazine came into widespread use in the mid-20th century, psychotic disorders were treated somewhat more invasively by the medical profession, including the use of electroshock therapy and surgical procedures, including lobotomy. The drug's first clinical trial, on psychotic patients at a Parisian hospital in 1952, produced astounding results, with the effects going beyond mere sedation and allowing the patients to display lucid, rational thought and improved behaviour. Very quickly, chlorpromazine injections became the standard treatment for schizophrenia and other manic disorders, as well as paving the way for the development of milder antidepressants.



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WAR WOUNDS

World War I brought about devastating numbers of life-altering injuries, as new weapons caused complex wounds that required new kinds of surgical techniques. From time-critical surgery performed on the frontline to new methods of facial reconstruction and treating the psychological scars of conflict, medical innovations emerged from the devastation of war

▲ HIDDEN INJURIES
Between 1914–18, the British Army dealt with 80,000 cases of shell shock. Symptoms varied hugely: some suffered mutism and paralysis or went blind or deaf, others developed stutters and tics or experienced nightmares, depression and anxiety. As doctors sought to understand what caused shell shock, a variety of treatments emerged, including hypnotism, occupational and talking therapies, and even electrotherapy.

▼ CRUCIAL TECHNOLOGY
Despite only being discovered in 1895, X-rays – known as Röntgen rays after the man who discovered them – were already being deployed in medicine by World War I and proved invaluable in war surgery. Here, German medical technicians use Röntgen apparatus in c1916.

▼ MEASURING UP
An estimated 240,000 British soldiers suffered total or partial amputations during World War I, so there was a real need for workshops like this one – probably associated with Queen Mary's Convalescent Auxiliary Hospital, London – which made and fitted artificial limbs for injured British soldiers.

◀ PIONEERING TECHNIQUES
In 1917, New Zealand-born surgeon Harold Gillies developed new methods of facial reconstructive surgery in response to the terrible injuries caused by new weapons of war. Masks were often an option for patients (*left*), but Gillies pioneered new ways – such as the tubed pedicle – to ensure skin grafts were accepted over the site of injury, laying the foundations of plastic surgery.

▶ HELPING HANDS
This young man is demonstrating, in July 1918, the American Red Cross's Adjustable Abduction Arm Splint. It was designed to be used for arm fractures and could be placed on either arm and adjusted to any position.

Student nurses at the School of Nursing, St Bartholomew's Hospital, London, 1968

THE NHS

One of the first completely free healthcare systems revolutionised public health

In 1942, the Beveridge Report recommended the initiation of "comprehensive health and rehabilitation services for prevention and cure of disease", a proposal that garnered cross-party support in the House of Commons. When the Labour Party won the 1945 General Election, one man was charged with drawing up and driving this new programme of health provision: the newly appointed Minister for Health, Aneurin Bevan.

Founded on the principles that healthcare should be universal and comprehensive, and not based on a patient's ability to pay, the National Health Service was launched in 1948, the cost of which was covered through taxation and National Insurance contributions (although the principled Bevan quit the role and his party when modest charges for glasses and dentures were introduced three years later). Since then, and despite near-constant discussion and crises about its funding, the NHS remains one of the cornerstones of British society – and was justly celebrated as part of the opening ceremony of the 2012 Olympic Games in London.

The service has grown hugely since Bevan's day. In 1948, the service employed approximately 11,700 doctors and 68,000 nurses. Seventy years later, in 2018, NHS nurses numbered 217,000, while doctor numbers had increased ten-fold. In 1948, though, the NHS boasted 480,000 hospital beds; by 2018, this figure was down to just around a third of that. But this isn't solely down to insufficient funding. The UK population in the 21st century is generally a much healthier one than in the years following World War II. And the NHS is hugely responsible for this, those principles of comprehensive and universal care helping to ensure that, as a nation, we live healthier, longer lives.

"No society can legitimately call itself civilised if a sick person is denied medical aid because of lack of means," Bevan once declared. And despite the heavyweight pressures caused by the Covid-19 pandemic, this doctrine remains the fundamental reason for the NHS's existence.

Health Minster Aneurin Bevan championed free healthcare for all

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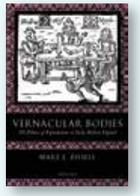
BOOKS



Vernacular Bodies: The Politics of Reproduction in Early Modern England
By Prof Mary Fissell (OUP, 2004)

Mary Fissell employs a wealth of popular sources – ballads, jokes, witchcraft pamphlets, prayerbooks, popular medical manuals – to produce the first account of women's reproductive bodies in early-modern cheap print, and explore the mysteries of early modern reproduction.

The Butchering Art: Joseph Lister's Quest to Transform the Grisly World of Victorian Medicine
By Lindsey Fitzharris (Allen Lane, 2017)

Historian Lindsey Fitzharris tells the story of how one of Britain's greatest medical minds finally brought centuries of savagery, sawing and gangrene to an end, and also finally managed to solve the 'riddle' of post-operative death.

The Invention of Medicine: From Homer to Hippocrates
By Robin Lane Fox (Allen Lane, 2020)

Robin Lane Fox puts the invention of medicine in a wider context – from the epic poems of Homer to the first doctors known to have been active in the Greek world – and examines what we *actually* know about Hippocrates and his Oath, and the many writings that survive under his name.

ONLINE AND AUDIO

▶ **The Making of Modern Medicine** *(BBC Radio 4):* A 30-part series exploring the history of medicine. Listen at *bbc.co.uk/programmes/b00k9b7r*

History Extra ▶ **For podcasts, features, quizzes, interviews and more on the history of medicine, visit our website: *historyextra.com/topic/medicine-and-health***

WATCH

Pain, Pus and Poison: The Search for Modern Medicines
(BBC Four, now available on BBC iPlayer)

Dr Michael Mosley reveals the hidden stories behind some of our most useful and valuable drugs, as well as early attempts to tackle infection and manage pain.

Radioactive
(Film, 2019)

A feature-length drama that documents the life of scientist Marie Curie – from meeting her future husband, Pierre, to her death at the age of 66, showcasing her world-changing discoveries and their effects.

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