



# SCIENCE JOURNAL

PRESENTS

# LOCKDOWN CHRONICLES

2020 EDITION

EDITOR: FARIHA HASAN



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Due to the pandemic and following lockdown, Science Journal has been sought out to thrive even in these trying times; I want to thank the Science Journal Team for putting effort and passion in this elective and working together to combine and produce the articles.

Next year there may not be the same team, but we can hope that the passion carries on and this form of journalism can provide someone comfort and confidence in their skills and creativity, and maybe spark the love for science and its history on Earth.

As this school year comes to a close, we can only hope that things will go back to "normal", and I wish that everyone is and will be in good health till we all meet again in September.

Fariha Hasan



# TELEPORTATION IN LIVE MUSICAL PERFORMANCE

A NEW STUDY EXPLAINS FOR THE FIRST TIME HOW QUANTUM SUPERCOMPUTERS COULD BE HELPFUL IN THE WORLD OF MAKING AND PERFORMING MUSIC.

Teleportation is most commonly the stuff of science fiction and, for many, would conjure up the immortal phrase "Beam me up, Scotty."

"However, a new study has described how its status in science fact could actually be employed as another, and perhaps unlikely, form of entertainment -- live music.

Dr Alexis Kirke, Senior Research Fellow in the Interdisciplinary Centre for Computer Music Research at the University of Plymouth (UK), has for the first time shown that a human musician can communicate directly with a quantum computer via teleportation.

The result is a high-tech jamming session, through which a blend of live human and computer-generated sounds come together to create a unique performance piece.

Speaking about the study, published in the current issue of the Journal of New Music Research, Dr Kirke said: "The world is racing to build the first practical and powerful quantum computers, and whoever succeeds first will have a scientific and military advantage because of the extreme computing power of these machines. This research shows for the first time that this much-vaunted advantage can also be helpful in the world of making and performing music. No other work has shown this previously in the arts, and it demonstrates that quantum power is something everyone can appreciate and enjoy.

"Quantum teleportation is the ability to instantaneously transmit quantum information over vast distances, with scientists having previously used it to send information from Earth to an orbiting satellite over 870 miles away.



In the current study, Dr Kirke describes how he used a system called MIq (Multi-Agent Interactive qgMuse), in which an IBM quantum computer executes a methodology called Grover's Algorithm.

Discovered by Lov Grover at Bell Labs in 1996, it was the second main quantum algorithm (after Shor's algorithm) and gave a huge advantage over traditional computing.

In this instance, it allows the dynamic solving of musical logical rules which, for example, could prevent dissonance or keep to  $\frac{3}{4}$  instead of common time. It is significantly faster than any classical computer algorithm, and Dr Kirke said that speed was essential because there is actually no way to transmit quantum information other than through teleportation.

The result was that when played the theme from Game of Thrones on the piano, the computer -- a 14-qubit machine housed at IBM in Melbourne -- rapidly generated accompanying music that was transmitted back in response. Dr Kirke, who in 2016 staged the first ever duet between a live singer and a quantum supercomputer, said: "At the moment there are limits to how complex a real-time computer jamming system can be.

The number of musical rules that a human improviser knows intuitively would simply take a computer too long to solve to real-time music. Shortcuts have been invented to speed up this process in rule-based AI music, but using the quantum computer speed-up has not been tried before.

So while teleportation cannot move information faster than the speed of light, if remote collaborators want to connect up their quantum computers -- which they are using to increase the speed of their musical AIs -- it is 100% necessary. Quantum information simply cannot be transmitted using normal digital transmission systems."

Story Source:

Materials provided by University of Plymouth.

Note: Content may be edited for style and length.

Journal Reference: Alexis Kirke. Testing a hybrid hardware quantum multi-agent system architecture that utilizes the quantum speed advantage for interactive computer music. *Journal of New Music Research*, 2020; 49 (3): 209  
DOI: 10.1080/09298215.2020.1749672



# THE HUMAN BODY IS A BIG DESIGN FLAW

A curious exploration  
conducted by the editor

Evolution is slow

The Greeks were obsessed with the mathematically perfect body. Evolution constructed our bodies with the biological equivalent of duct tape and lumber scraps. And the only way to refine the form (short of an asteroid strike or nuclear detonation to wipe clean the slate) is to jerry-rig the current model. “Evolution doesn’t produce perfection,” explains Alan Mann, a physical anthropologist at Princeton University. “It produces function.”

## An unsound spine

**Problem:** Our spines are a mess. It’s a wonder we can even walk, says Bruce Latimer, director of the Center for Human Origins at Case Western Reserve University, in Cleveland. When our ancestors walked on all fours, their spines arched, like a bow, to withstand the weight of the organs suspended below. But then we stood up. That threw the system out of whack by 90 degrees, and the spine was forced to become a column. Next, to allow for bipedalism, it curved forward at the lower back. And to keep the head in balance—so that we didn’t all walk around as if doing the limbo—the upper spine curved in the opposite direction. This change put tremendous pressure on the lower vertebrae, sticking about 80 percent of adults, according to one estimate, with lower back pain.

## An inflexible knee

**Problem:** As Latimer says, “You take the most complex joint in the body and put it between two huge levers—the femur and the tibia—and you’re looking for trouble.” The upshot is your knee only rotates in two directions: forward and back. “That’s why every major sport, except maybe rugby, makes it illegal to clip, or hit an opponent’s knee from the side.”

## Crowded teeth

**Problem:** Humans typically have three molars on each side of the upper and lower jaws near the back of the mouth. When our brain drastically expanded in size, the jaw grew wider and shorter, leaving no room for the third, farthest back molars. These cusped grinders may have been useful before we learned to cook and process food. But now the “wisdom teeth” mostly just get painfully impacted in the gums.

## A misrouted nerve

**Problem:** The recurrent laryngeal nerve (RLN) plays a vital role in our ability to speak and swallow. It feeds instructions from the brain to the muscles of the voice box, or larynx, below the vocal cords. Theoretically, the trip should be a quick one. But during fetal development, the RLN gets entwined in a tiny lump of tissue in the neck, which descends to become blood vessels near the heart. That drop causes the nerve to loop around the aorta before traveling back up the larynx. Having this nerve in your chest makes it vulnerable during surgery—or a fist fight.

### References:

(2009).2. Marcus, G. Kluge: The Haphazard Evolution of the Human Mind Houghton Mifflin, Boston, MA (2008)

Article BY CHIP ROWE



Source: Vienna University of Technology

The way graphene interacts with other materials depends on how these materials are brought into contact with the graphene. The appropriate atoms are brought into contact with the graphene in such a way that they 'grow' on the graphene in the desired crystal structure. Until now the mechanisms of the 'growth' of such other materials on graphene have often remained unclear. A new study shows now how indium oxide grows on graphene.

Graphene consists of a single layer of carbon atoms. Exceptional electronic, thermal, mechanical and optical properties have made graphene one of the most studied materials at the moment.

For many applications in electronics and energy technology, however, graphene must be combined with other materials: Since graphene is so thin, its properties drastically change when other materials are brought into direct contact with it.

However, combining graphene with other materials at the molecular level is difficult: The way graphene interacts with other materials depends not only on which material you choose, but also on how these materials are brought into contact with the graphene. Rather than sticking a finished material layer to the graphene, the appropriate atoms are brought into contact with the graphene in such a way that they "grow" on the graphene in the desired crystal structure.

Until now the mechanisms of the "growth" of such other materials on graphene have often remained unclear. A new joint study by research teams from the TU Wien and the University of Vienna for the first time observes now how indium oxide grows on graphene. The combination of indium oxide with graphene is important, for example for displays and sensors. The results have now been presented in the scientific journal "Advanced Functional Materials". Graphene pizza "As with a pizza, graphene technology is not only dependent on the graphene pizza base but also on its toppings," explains Bernhard C. Bayer from the Institute of Materials Chemistry at the TU Wien, who led the study. "How these toppings are applied to the graphene is, however, crucial." In most cases, atoms in the gaseous state are condensed on the graphene. In the case of indium oxide, these are indium and oxygen. "But there are many parameters such as background pressure, temperature or the speed at which these atoms are directed at the graphene that influence the result drastically," says Bernhard Bayer. "It is therefore important to develop a fundamental understanding of the chemical and physical processes that actually take place.

But to do this, you have to watch the growth process as it proceeds. "This is exactly what the research team has now succeeded in doing: for the first time, the individual steps of growing indium oxide on graphene were observed in the electron microscope at atomic resolution. Randomly distributed or perfectly aligned" What was particularly interesting for us was the observation that, depending on the background pressure, the indium oxide crystallites either arrange themselves randomly on the graphene's crystal lattice or snap perfectly on one another like Lego bricks. This difference in arrangement can have a major impact on the application properties of the combined materials," says Kenan Elibol, first author of the study. The new findings will be useful to make the integration of graphene with other materials more predictable and controllable with respect to future application requirements.

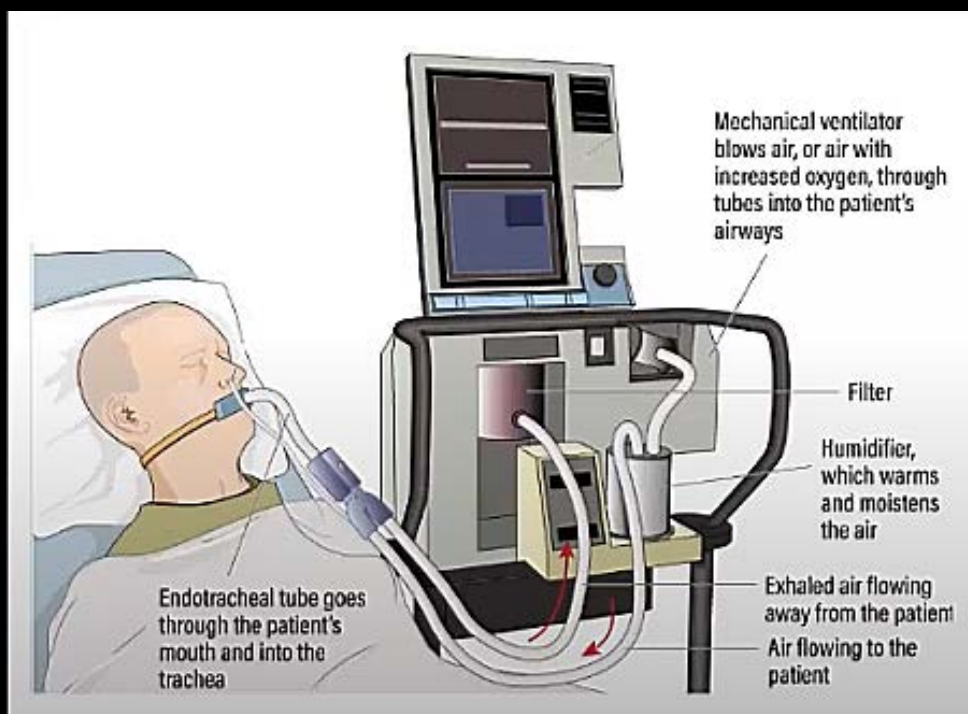


# THE CPAP SAVIOUR

These past few months, COVID has been a hot topic. Many healthcare settings and staff were rushing to keep up and cope with the tragedies that followed this viral catastrophe.



Covid is a disease that was not seen before so the way it attacks the body was completely different. so there was a learning curve to how to manage these patients. these are chest X-Rays that came from China. The lungs usually appear in black on an X-ray and you can see day by day there's increased fluffiness which is indicative of severe inflammatory response in the lungs. many of the patients in Wuhan initially, then in Italy, and then traveled to Spain, UK, etc. Suffered a severe drop in oxygen levels in their blood which needed them to become hospitalized. about 15% of these patients couldn't cope with just an oxygen mask alone. it wasn't sufficient to get enough oxygen into their bloodstream so they needed more respiratory support.



And the traditional way of doing that is to use the ventilator. this is where the patient is heavily sedated, paralyzed and then a tube is put through the mouth into the trachea, the windpipe that's then connected to a *bellows*, a mechanical ventilator that pushes air in and out.

The problem was in Wuhan and then it got replicated in Italy, that there was a sudden rush of these critically ill patients that it overwhelmed the resources available. The critical care resource and the ventilator resource.



# UK'S RESPONSE

There was little time to prepare. It was evident that the uk's reaction was slow despite the headstart that we've had from italy and china's impact and experiences.

*"In Stage One, we say nothing is going to happen,*

*In Stage Two, we say something may be going to happen but we should do nothing about it.*

*In Stage Three, we say that maybe we should do something about it, but there's nothing we can do.*

*In stage Four, Maybe there was something we could have done, but it's too late now."*

-YES MINISTER, BBC POLITICAL SATIRE 1980S

On the 13th of march, when boris johnson announced that there would be unfortunately many deaths in the uk, that seemed to come to light later on in the days.



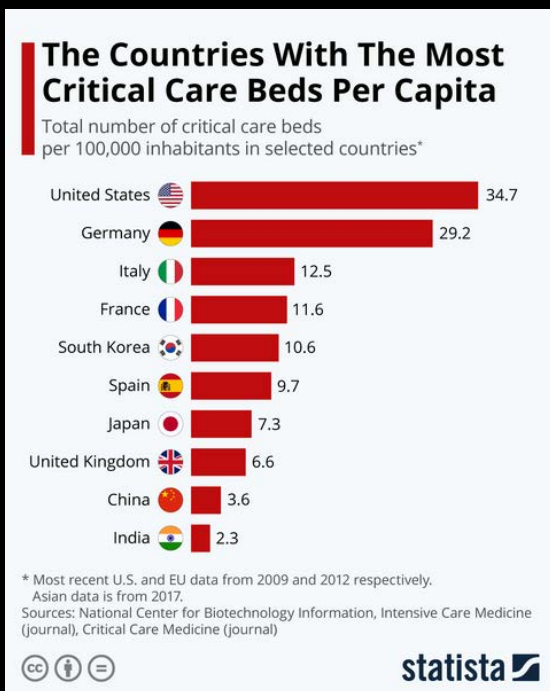
On the 16th of march, there were many headlines modelling that huge number of patients would be ending up in hospitals in the uk.



Because of the lack of critical care beds, there was a situation where priority to patients and beds were rationed.



As it can be seen from the chart, the uk lags behind other developed countries in the number of critical care beds.



- UK have only 3,500 ICU beds
- By using anaesthetic machines and private sector ventilators, capacity increased to 8,000
- Modelled need ...
- ... up to 40,000 ventilators

Then there were reports from italy and the situation they were facing, which was a near future projection for what uk would be facing in the weeks to come.



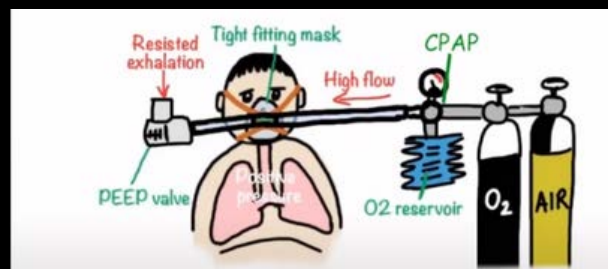
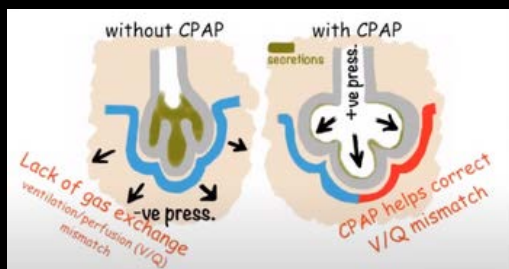
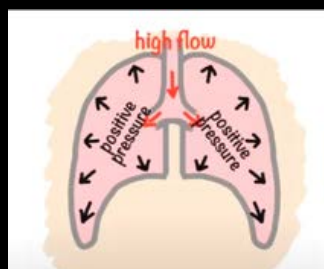
## THESE ARE NOT VENTILATORS...



...but they are non invasive respiratory support. Patients can be awake and breathe normally. These helmets are called *bubble cpap*.

## WHAT IS CPAP?

cpap stands for *continuous positive airway pressure*. So in patients in whom an oxygen mask isn't good enough but perhaps you don't want to fully ventilate them, it's a good alternate. And this positive pressure splints the lungs open and improves oxygenation of the blood and that obviously helps the body get more oxygen.



So the positive pressure, without the CPAP, the alveoli at the basis of the lungs collapsed down. with CPAP, however, it splints the alveoli open and it helps blood flow through the lungs and its ability to pick up oxygen.

And so the patient wears a tight fitting mask. the patient would breathe out through a valve and this valve was called a *peep valve* which allows the patient to breathe out against the resistance, so rather than breathing out against atmospheric pressure there's a little bit of positive pressure that keeps the lung splinted open.



TIGHT MASK



BUBBLE HELMET



NASAL MASK



WHOLE FACE MASK

the masks that the patient can wear can either be a tight mask covering the nose and mouth, one over the nose, a whole face mask, this bubble helmet hood type of approach so it's sealed to allow a good flow of air under pressure. However, there was a lot of worry about CPAP. The World Health Organization, many national guidelines including the UK, because of the fear of transmission of the COVID virus. Through *aerosolization* due to the high flow and therefore a risk to health care workers.

However, needs must. And despite these guidelines doctors in China and Italy had turned to CPAP because they didn't have the ventilators, they didn't have the intensive care beds and they wanted to spare these for the most needy.



## HOW SUCCESSFUL IS CPAP?

in China and in Italy health care professionals have said that about 30 to 70% of patients managed with CPAP could be kept off a ventilator thus reserving that resource for those who really needed it. Importantly there were no reports of serious infection in health care workers, doctors, nurses, caring for these patients.

## HOW DID UCLH RESPOND?

- Clinical management algorithm, commencing at the front door (ED)
- Training of doctors and nurses
- Sought to purchase more CPAP machines (only had 12 in whole hospital)  
.. but none available

16 MARCH 2020



- Misguided!
  - Sophisticated machines needed to cope with bad lungs can't be made in weeks
  - Shortage of trained ICU staff to cope with large influx of patients



## THE RACE OF INDUSTRIES

On the 16th of March Boris Johnson announced that he was asking UK industry to help make ventilators. There was a shortfall of about 30000 ventilators so he appealed to companies like Dyson, Rolls Royce, Airbus, to make ventilators to try and fill the gap. this was completely misguided for two reasons.



Firstly, these are very sophisticated machines and to ask companies who had no experience in making ventilators to make them from scratch in a few weeks was an impossibility. These machines take months, years to develop so to get it done in weeks would be, an impossible task. Secondly, with the anticipated rush of patients, there wouldn't be the beds and the intensive care staff who could look after mechanically ventilated patients. special training would be needed, because without that, it can endanger the patients' lives.

The whisper flow was a very old device, which was invented by a small company in the early 1990s was a purely mechanical device with 3 knobs, on/off button and another button to adjust how much oxygen was coming from the wall oxygen supply. There was also another button to adjust the flow rate .

the challenge was getting approval, that these would not harm the patients and the problem that many factories had closed down due to lockdown.

## WHISPERFLOW CPAP



- Old device - no longer made - out of patent
  - Simple to operate
  - Easy to get regulatory approval
  - Much simpler to make
- .. but how quickly could it be made at scale?  
.. and during a global lockdown?

**Coronavirus: Museum piece designed in West Sussex is re-engineered to help save lives**

A breathing device first designed and produced in West Sussex nearly 30 years ago has been re-engineered to help save lives during the coronavirus pandemic.

By Sam Wicks

The system was developed in the early 1990s by a team led by the then head of engineering, John Carter (pictured), and was used in a number of hospitals around the world.

A professor from University College London (UCL) remembered the Whisperflow CPAP device and found it in the hospital museum when the college was called on by the government to look at the supply of ventilation equipment to deal with the outbreak.

## ENTER MERCEDES FORMULA ONE RACING TEAM

UCL's Professor of Mechanical Engineering, in an earlier life, had worked designing and building engines for Formula One teams, so he had many strong connections, one of whom was the chief engineer at Mercedes AMG HPP, The high-performance powertrain factory in Northamptonshire that made the engines for Formula One cars. It's a big factory, in which 800 really skilled engineers and technicians work.



LEWIS HAMILTON



So the top 4 engineers were dispatched.



They did a CT scans of the whisper flow , They found one themselves on eBay. There were computed aided designs. They looked at the flow through the machine and they built some prototypes. They Precision engineered them And this was the final product. And they did this in just 100 hours after 17th of March.

0-100 HOURS...



once it was made it was tested for efficiency and safety, and also seeked approval by supplying the validation data.

The UCL Comms team went into action and the BBC were really keen to highlight this and Fergus Walsh, the medical correspondent came and filmed on the 27th of March. He cut it over the weekend and it was announced on the BBC website.

*"Delivers oxygen to the lungs without the need for a ventilator. Here's our Medical Correspondent Fergus Walsh."*

*"It's a small device that could make a big difference*

*known as continuous positive airway pressure or CPAP. It pushes oxygen into the lungs keeping*

*them open making it easier to breathe. They're already used in the NHS but are in short supply so a team modified and improved an existing design in less than a week which has now been approved for use by health regulators."*

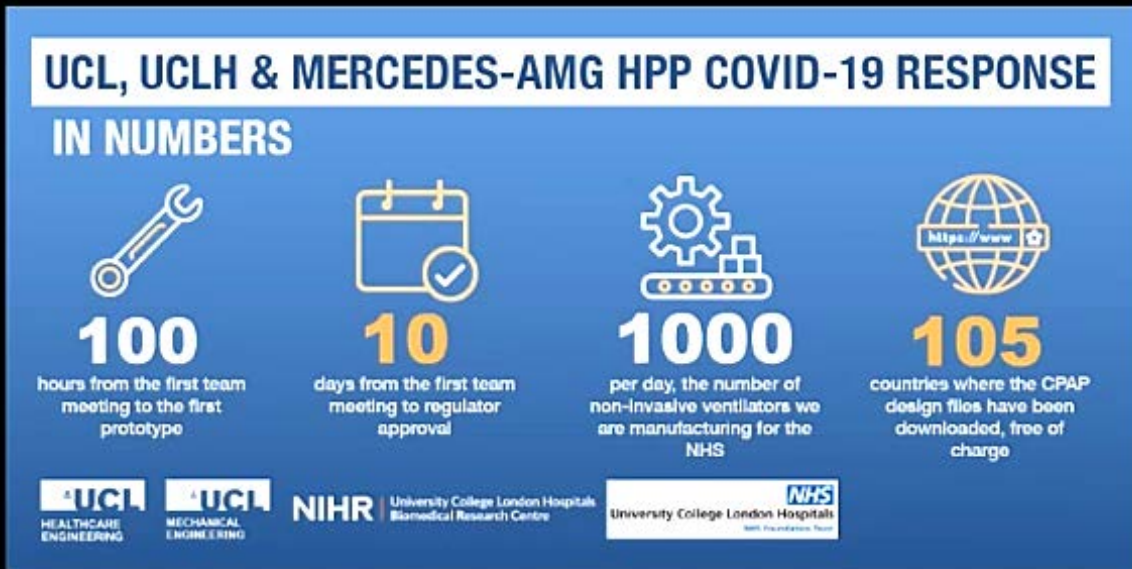
and this story went viral.





# HELPING HAND FOR THE WORLD

clearly everyone else had been suffering from covid, and there are countries that weren't as rich and developed as the uk, so the designs were made freely available for any legitimate organization, government, healthcare provider, research institution or a manufacturer.



Now being made locally, donated or purchased at cost:

Canada, Iran, India, Australia, South Africa, Peru, Mexico, Ecuador, Columbia, Uruguay, Paraguay, Palestine, Bangladesh ...



**Thank you NHS!**



**Mervyn Singer** is a professor of intensive care medicine at ucl, and has major interests in getting technology out of the labs and getting it to the patients who need it.



# MENTAL HEALTH DURING THE LOCKDOWN

BY GIRTHIGA DAMILVANAN



## WHAT HAS IT BEEN LIKE DURING THE LOCKDOWN?

Beginning with eating disorders, those that are affected by this, will have the comfort of loved ones and friends around them. The chance to go to the hospital to get professional help face to face. But since lockdown, all of this has been restricted. All of the help that was offered to them before is now broken down to a phone call. This is not helping them in their journey to recovery and to 'normality.' It pushes them further away. Nothing has been properly put in place.

This unfortunately goes into those with mixed anxiety and depression. Having mixed anxiety is like a tornado. You have both anxiety and depressive symptoms. This is difficult to cope with alone. Some can but most can't. So, it brings us to once again the comfort and support of loved ones. All that is given to them now is once again a phone call.

Mental health is a fragile and sensitive topic for most. During the lockdown, it's been difficult to cope with it for most. Once the lockdown is lifted and life is back to normal, or as normal as it can get, those who need help desperately will soon get it.



## WHAT WAS MENTAL HEALTH LIKE BEFORE IN THE UK?

In the UK, the most common mental health disorders are:

- Mixed anxiety
- Depression
- Eating disorder (this includes: anorexia, bulimia, binge eating, etc)

In England, mental illness is the 2nd largest source of burden of disease. This is shown through several figures. Such as how mental health is responsible for the loss 72,000,000 working days and how it costs a massive £34.9 billion each year. Just think to yourself as to how big that number is, and how since lockdown has happened, the economy has started to fall apart.

As well as this, on average it is said that people with a long-term mental health condition lose their jobs every year at around double the rate of those without a mental health condition. This equates to 300,000 people. The equivalent of the population of Newcastle!

And bringing this sensitive topic close to home for some of us, in an average classroom, 10 children will have witnessed the separation of parents, 8 will have experienced severe physical violence or neglect, 1 will have experienced the death of a parent and 7 will have been bullied.

All of these numbers are too high. It was difficult enough to help those coping with their trauma but after lockdown they have been forgotten about.



Learning from home can be hard. Reading at home is not something we find as easy as switching the PS4 or Netflix on and getting warm and comfy in our plush seats. However, reading for pleasure is such a wonderful, gratifying skill to have. Reading at any time of the day, helps with memory, problem-solving, imagination, speaking and writing skills too. It's also a great way to relax and can help you sleep well. Especially in this lockdown ;

*"Reading gives us someplace to go when we must stay where we are"*

Mason Cooley

Go ahead. Why not travel the world? Meet, experience and indulge yourself in different ethnicities and cultures while spontaneously encountering wild, feral and beautiful species, aliens, fanatical myths and legends and so much more. Begin a new life, find a new home, make new friends, laugh, cry and fall in love with them -- have your soul torn and pieced meticulously together, all while dancing through a couple of pages. Why not? You have the opportunity- snatch it away from other prying eyes. Become the best you can be, mentally, emotionally and psychologically. Get on the level that you wish to see yourself at in the future.

Go ahead. Pick up that book. Go online to our school library website. Finish that book that you've been procrastinating for weeks now. Do it. Because this is my challenge to you: Read a new book every two weeks. That's right; 2 to 3 books a month (more if you're ambitious!). That would be approximately 24 to 25 books a year. Look at all that progress you've just made! From little to nothing... to 2 dozen books a year! Can you fathom the knowledge, stories and understanding that you've now gained in just one year? Brilliant, right?

Currently, I'm reading a classic called: *"Tess of the D'Urbervilles"*. A book of conflict, love, salvation and a powerful criticism of social convention. Tess Durbeyfield (the protagonist) is driven by family poverty to claim kinship with the wealthy D'Urbervilles to seek a portion of their family fortune, however, meeting her 'cousin' Alec proves to be her downfall. From here the story begins to unravel at a thundering speed towards the climax. It's a really good read for those that want to indulge themselves into a different society and dive into a conflicting, intimate story.



EDITORS PERSONAL AND HONEST REVIEWS ON POPULAR BOOKS:



When it comes to an aspiring medic's recommended choice of books, this is a must. It is a very honest account from a former gynecologist's viewpoint and has accurate scientific explanations, but aside from its glory, I thought that the overbearing details of a doctor's hardship discourages aspiring med students, and casts a misleading light for doctors in the audiences minds. The humor may have made a difficult topic easier to approach but it was not always funny nor it was always appropriate. I just wish that the book had a more serious tone at some points. Now these are no reasons to not read this, after all, its probably the closest you can get to experiencing the life of a doctor in their shoes.

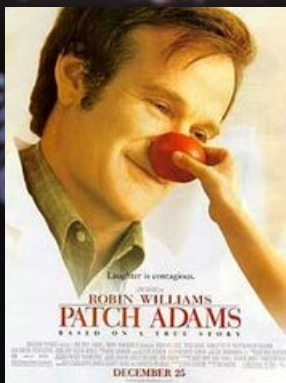


Now apparently, this book is popular too. I *tried* to read it, listen to an audiobook, listen to someone read it and give a basic explanation (which had little success I must add), and had come to the conclusion that unless you knew anything about relativity or cosmology, this would be a good "bought but not read" book that would sit nicely on your bookshelf and make you feel smarter (or dumber). Whichever it may be, this may explain why it's so universally acclaimed as a work of genius. Somehow Stephen Hawking has written a book that gently notions to Schrödinger's cat , which is one of the few points I probably understood from this book as a whole.

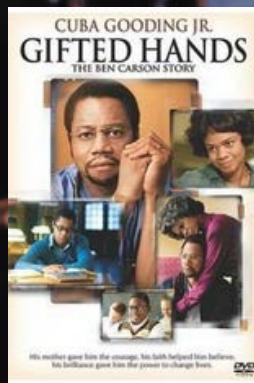


Lee's novel is about racism and society in 1930s America. The specific relevance to Law students is that its main character, Atticus Finch, is a lawyer tasked with defending a man shunned by everyone else. Finch represents the legal ideals of justice and equality, and the book is a great source of inspiration for those wondering why law is important, and why rights must be protected. Legal heroes (even fictional ones) remind us why there are people courageous enough to study law. Though in my opinion, the justice system in this fictional world seems problematic: Atticus, as much as I like him, is a white savior. It makes a little bit of sense in the time period, but it surely does not fit in times like now, when white people need to step back and make sure to let people of color have a voice. And the fact remains that this book is a book about racism... written by a white woman in Western society. It's nice that she tries to tackle racism and bring awareness to it or whatever, but Harper Lee could not have written a book accurately educating about racism against Black people because she has no experience in it.

**MOVIES**



This comedy/drama, released in 1998, portrays the experiences of a medical student (Robin Williams) who truly believes that sometimes, laughter is the best medicine.



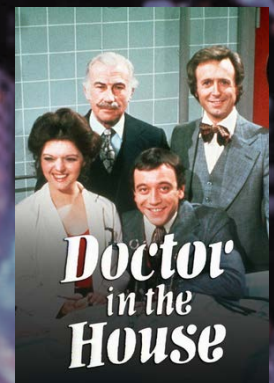
This 2009 TV movie starring Cuba Gooding, Jr., he film examines the true story of Ben Carson, a renowned brain surgeon who overcame obstacles to change the course of medicine forever.



A psychiatrist protects the identity of an amnesia patient accused of murder while attempting to recover his memory.



The victims of an encephalitis epidemic many years ago have been catatonic ever since, but now a new drug offers the prospect of reviving them.



The movie follows the misadventures of medical students. The lads basically mean well, but their habits of skiving off and attempting to chat up every available nurse drives the ferocious Professor Geoffrey Loftus to distraction.