the
HORIZON

LIFESTYLE, PRODUCTIVITY, CULTURE & SO MUCH MORE......

The "care" in healthcare

How to make doctors feel Safe !

ARight Time for coffee ?

3D Bioprinting

DEAN'S DESK

Dear students, we at Grodno State Medical University strive to provide students with top-quality education, but that's not it. GRSMU is also a hub for Scientific, Cultural, and Sports related activities. We wholeheartedly acknowledge that International students are an integral part of our university, and we take immense pride in that. Grodno State Medical University is glad to work with students from different countries and provide them with a stage to represent their nation and culture.
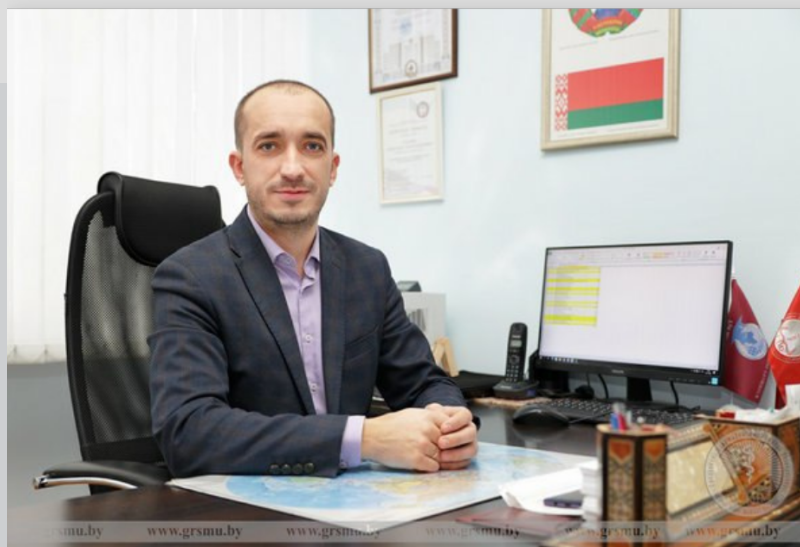
DEAN OF FACULTY OF INTERNATIONAL STUDENTS
Dr. ALEKSANDER ALEKSANDEROVICH STENKO

GRSMU celebrates its uniqueness in diversity, for in its true essence our university is a junction where students from various backgrounds and cultures come together as one big family. GRSMU has always encouraged students to explore further and beyond in every field they try their hands at. I hope that you like the novel concept of 'The Horizon' - a magazine that serves as a platform for the students to voice their opinions, share their takes and present their points of view.

'**The Horizon**' is a medium of extended communication where we can learn a lot from one another.
I highly appreciate this initiative and personally support it. I look forward to reading the interesting blogs written by you.

WELCOME TO THE HORIZON

"We all have fascinating stories to share!" For the longest time, I have had this idea of starting a magazine. But not just any conventional magazine, one that shall serve as a platform for the students and Alumni of International faculty at Grodno State Medical University to share their stories. A platform that enables students to share their takes on various curricular and extracurricular aspects of medicine. Thus, the idea of **'The Horizon'**, came to life.

MEHUL H. SADADIWALA, EDITOR-IN-CHIEF (JAN-APR, 2023)

'The Horizon' will be a creative intersection where students can freely give commentaries about Lifestyle, Culture, Productivity tips, and more. Throughout the years, many individuals at GRSMU have inculcated valuable skills and gained experience with a fair share of success in various disciplines. Maybe you run a successful YouTube channel or an educational website, or maybe you are a successful student-researcher or an educator, and so much more. 'The Horizon' enables students to share their personal experiences. The insights that you share will encourage other students to take further strides and explore future possibilities.

'The Horizon' is supported directly by the Dean of the International Faculty, and it will operate under the supervision of the International Students' Scientific Committee. Students from 1st to 6th year, and even graduates, can submit their blogs to this magazine. The articles should directly or indirectly revolve around student life to share knowledge and the collective growth of students.

MAKING SENSE OF 'CARE' IN HEALTHCARE

The highlight of this blog has been the increasing use of Artificial Intelligence (AI) in healthcare and addressing the growing insecurity of medical professionals.

WRITTEN BY
MEHUL H. SADADIWALA
CLASS OF 2023

With changing times there has been a growing sense of insecurity amongst medical professionals with their jobs being replaced by Artificial Intelligence (AI), and the rate at which the use of AI has been increasing is to be held accountable. This extensive application of AI in certain fields of medicine (like Radiology, Dermatology, and Pathology) owes to the element of Human error or ignorance that can be conveniently mitigated by well-trained computer models. These unprecedented advancements in AI technology and its growing dependency have led to a scare among professionals of losing their hard-earned jobs to machines.

Introducing AI systems into healthcare may ease the cognitive burden of drawing diagnostics, and automation of tedious tasks, such as paperwork and computerizing data, could free up time for health professionals which can be diverted towards engaging more directly with their patients.

But this raises the issue that AI systems could be used from an economic point of view to employ lesser staff with lower qualifications since less expertise will be needed. This can be problematic because if there were to be a technical collapse, the incompetent staff would not be able to recognize any errors, and even if detected, they wouldn't be skilled enough to compensate for the issue at hand. Thus, it is quite important to have well-trained and practicing experts at your disposal as it became quite evident during the latest pandemic.

The revolutionary input that AI has brought to Heath monitoring and consultations is remarkable. From wearable fitness bands that are quite accurate in detecting arithmetic episodes to the rise of teleconsultations during the pandemic, the new avenue has limitless potential and possibilities.

Figure 1 *Artificial Neural Network code to train machine learning model*

Photo Credit *Harshil R. Nandwani, NEU, Boston, USA*

Relevant Articles

1. *Haenssle, H A et al. "Man against machine: diagnostic performance of a deep learning convolutional neural network for dermoscopic melanoma recognition in comparison to 58 dermatologists." Annals of oncology : official journal of the European Society for Medical Oncology vol. 29,8 (2018): 1836-1842. doi:10.1093/annonc/mdy166*
2. *Försch, Sebastian et al. "Artificial Intelligence in Pathology." Deutsches Arzteblatt international vol. 118,12 (2021): 194-204. doi:10.3238/arztebl.m2021.0011*
3. *Liu, Xiaoxuan et al. "A comparison of deep learning performance against health-care professionals in detecting diseases from medical imaging: a systematic review and meta-analysis." The Lancet. Digital health 1 6 (2019): e271-e297 .*
4. *Davenport, Thomas, and Ravi Kalakota. "The potential for artificial intelligence in healthcare." Future healthcare journal vol. 6,2 (2019): 94-98. doi:10.7861/futurehosp.6-2-94*

Radiology, Dermatology, and Pathology are image-abundant specialties and are strongly tied to the use of Deep-learning image processing. A paper was published in 2018, in the journal Annals of Oncology, the results of which demonstrated that skin cancer could be detected more accurately by an AI system (using deep learning convolutional neural network) than by actual dermatologists. The human dermatologists accurately detected approximately 86% of skin cancers from the images, compared to 95% for the convolutional neural network machine.[1] Similarly, several artificial neural network models have shown accuracy similar to that of human pathologists and radiologists. [2,3]

Simultaneously a bothersome prospect can be of crippling dependency of the new generation of physicians on the judgment of AI which can provide an expedient route of not undergoing the traditional learning which might prove to be of great use in areas deprived of equipment and technology or in situations of technical malfunction. Still, we have not touched on the intense topic of Robotic surgery that carries with it the ability of impeccable micro precision, surpassing the skill of any surgeon that trained for decades.

> 66 The future is not Humans vs Machines, but Humans & Machines 99

Although no jobs have been replaced by AI so far, studies have shown that in the next 10 to 20 years, up to 35% of jobs in the UK are highly susceptible to being replaced by AI. The most vulnerable specialties are the ones dealing with digital information, radiology, and pathology, as opposed to those dealing with the doctor-patient interaction. [4]

The application of AI systems in healthcare may cause healthcare practitioners to feel threatened by this new form of technology, especially if their expertise, autonomy, or authority is challenged. Physicians, Assistant-Physicians & Nurses are HealthCare professionals, and if AI technologies are used to replace healthcare professionals, then there would be a loss of human contact – an essential element of physician-patient relationships. While the usage of AI is only supplemental for the moment, undoubtedly it will become an integral part of future diagnostic practices. What AI brings to the table cannot be overlooked.

The existence of both entities will be interdependent and symbiotic in nature, as without the assurance of qualified physicians the patient would not be able to understand or trust how the AI system arrived at the diagnosis or the treatment plan. Technology is here and it is here to stay, but the element of Care remains irreplaceable and can only be delivered by a fellow human.

"Empathy cannot be uploaded to a device", this statements holds to be very true as no software on this planet can replace the connection of human touch. The simplest gesture of holding a distressed and anxious patient's hand for reassurance, offering a warm blanket, or tending to the special needs of a patient can elevate the patient experience in immeasurable ways. Of course, the future is not Humans vs Machines, but Humans & Machines. But with the rate at which AI has been progressing, it wouldn't be long that the possibility that certain fields in medicine might soon not hold a lot of value. This may lead to careful consideration of career options keeping the uncertainties of the future in mind.

NECESSITY OF MAKING DOCTORS FEEL "SAFE"

The highlight of this blog is unlawful acts of violence towards healthcare professionals, existing laws, and counter- measures for self protection & avoiding such circumstances.

WRITTEN BY

JABIR R. MISTRY

CLASS OF 2023

At present times we are witnessing an increment in unlawful acts and violence in our society against doctors.Health professionals are dedicating their lives for wellbeing of community since centuries. Such circumstances Impact our society at a much greater level.

Researches and studies have shown that rules against violence towards medical professionals are being regulated by appropriate bodies.As we see an increment in social media usage, sharing of misinformation through videos and images by public has also given a boost to such actions.Crimes done towards doctors are mainly connected to professional activity.

Geographically, violence against healthcare professional has occurred in the form of physical violence, verbal abuse, aggressive gestures, blackmail, and cyber-bullying is observed in the United States, Australia, India, China, Pakistan, Nepal, Sri Lanka.

Indian medical association has reported 75% of cases face verbal abuse, physical assaults and due to fear of violence 43% doctors were under stress. Factors that caused violence against doctors are,absence of post-graduate training in emergency medicine, long working hours of up to 120 hrs a week for doctors, demonisation of doctors in news media.Errors in infrastructure, poor mechanism for grievance redressal, delayed legal procedural outcomes, a poor emergency network among hospitals, poor communication skills of healthcare workers, resource poor emergency settings (fewer drugs, fewer facilities for investigations), high patient load, lack of proper training of healthcare staff, high work load, and excessive political interference in hospital affairs.

> " WHEREVER THE ART OF MEDICINE IS LOVED, THERE IS ALSO A LOVE OF HUMANITY (HIPPOCRATES) "

There have been several cases in past portraying the misconduct by doctors in workplace that is the reason we have regulatory bodies to control such acts. Judicial system has laws for such activities and these should be maintained.

"International encyclopedia for laws" has a category of "Medical Law" focussing on the ethics for medical practice.
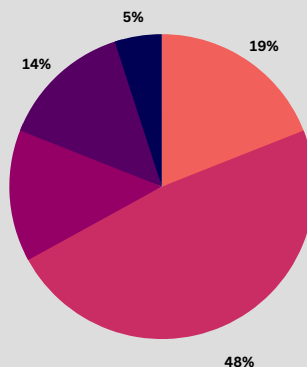
A study conducted in Italy showed healthcare workers have a 16 times greater risk of suffering workplace violence than workers in other sectors and around 50% experience workplace violence in the course of their career. This study shows statistics of 1988-2019 and Variables such as perpetrator, motive and location of the crime were obtained through forensic psychiatric department.

Over the period considered, 21 doctors were killed in Italy in connection with their professional activity. In 52% (n = 11) of cases, the killer was one of the doctor's patients, in 29% (n = 6) of cases it was a patient's relative, in 19% (n = 4) an occasional patient (first consultation). The location of the homicide was a community clinic in 48% (n = 10) of cases, the street in 19% (n = 4) of cases, the doctor's home in 14% (n = 3), the hospital in 14% (n = 3) and the patient's home in 5% (n = 1). In 57% (n = 12) of cases the perpetrator was not affected by any mental disorders. The motive for the homicide was revenge in 66.7% (n = 14) of cases; in 28.6% (n = 6) the revenge was preceded by stalking.
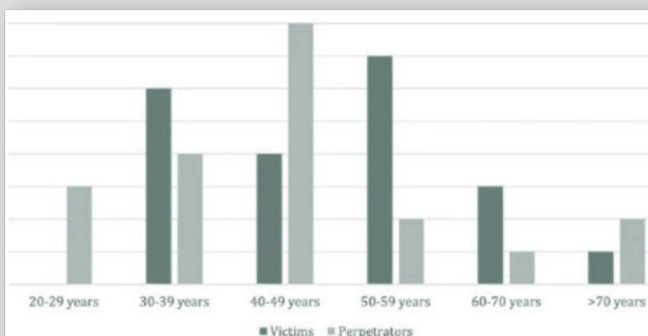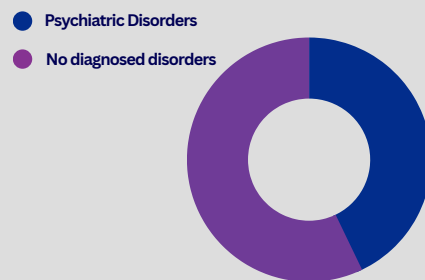
Every country has their own laws with regards to malpractice by medical professionals and crimes against them.Ministry of Health and Family Welfare has published a letter "MECHANISM TO PREVENT VIOLENCE AGAINST DOCTORS" :-Further, violence against healthcare professionals is a criminal offence and needs to be dealt suitably by the State /UT Governments under provisions in Indian Penal Code (IPC)/ Code of Criminal Procedure (CrPC) so that doctors/clinical establishments discharge their professional pursuit without fear of violence.

COUNTER MEASURES
a)Security of sensitive hospitals to be managed by a designated and trained force,
b)Installation of CCTV cameras and round the clock Quick Reaction Teams with effective communication / security gadgets particularly at Casualty, Emergency and areas having high footfalls,
c)Well-equipped centralized control room for monitoring and quick response,
d)Entry restriction for undesirable persons,
e)Institutional FIR against assaulters,
f)Display of legislation protecting doctors in every hospital and police station,
g)Appointment of Nodal Officer to monitor medical negligence,
h)Expeditious filling up of vacant posts of doctors and para-medical staff in hospitals / Primary Health Centres (PHCs) to avoid excessive burden / pressure on doctors and to maintain global doctor-patient ratio,
i)Better infrastructural facilities and medical equipment and provision of extra monetary incentive for the doctors and para medical staff serving in hard/remote areas as compared to major and metro cities with better career prospects, etc.

To put it in a nutshell,we as a society should have accountability and responsibility for our actions. Malpractice and misconducts should be condemned but in a legal way. Taking steps in a sensible manner is the way to an ideal society. "Together we can be the change".

- Patient's Home 5%
- Street 19%
- Primary Healthcare Facility 48%
- Victim's Home 14%
- Hospital 14%

Proportional distribution of murders of doctors by location in Italy, from 1988 to 2019(pie chart)

Clinical features of perpetrators of murdering of doctors in Italy, from 1988 to 2019(psychiatric comparison)

- Psychiatric Disorders
- No diagnosed disorders

Age distribution of doctors murdered and their perpetrators in Italy, from 1988 to 2019(graph)

■ Victims ■ Perpetrators

Relevant Articles

1. May 4, Sushmi Dey | TNN | Updated (4 May 2015). "Over 75% of doctors have faced violence at work, study finds India News - Times of India". The Times of India. Times of India. Retrieved 14 June 2019.
2. Perappadan, Bindu Shajan (2 July 2017). "Majority of doctors in India fear violence, says IMA survey". The Hindu. Retrieved 14 June 2019.
3. Lorettu, L., Nivoli, A.M.A., Daga, I. et al. Six things to know about the homicides of doctors: a review of 30 years from Italy. BMC Public Health 21, 1318 (2021). https://doi.org/10.1186/s12889-021-11404-5
4. Mohammad Naseem, Saman Naseem, 'International', (2022), pp.1-268 in Herman Nys (ed.), IEL Medical Law, (Kluwer Law International BV, Netherlands),
   https://kluwerlawonline.com/EncyclopediaChapter/IEL+Medical+Law/MEDI20190002
5. HFW/PQ/Mechanism to prevent violence against doctors/15thMarch 2022/

EVER WONDERED WHETHER THERE IS A 'RIGHT' TIME TO DRINK COFFEE?

The highlight of this blog is understanding the correlation between cortisol levels and coffee to determine the most ideal time to consume coffee.

WRITTEN BY

MARIYAM SHINA H.

CLASS OF 2023

Are you a
PROCAFFEINATOR?

(n.) somone who delays all tasks until after the first cup of coffee.

Coffee is a well-known pharmaceutically active beverage packed with antioxidants that helps with many health problems. It has ingrained itself in the mechanisms of so many people's early morning routines. For most of us, it is impossible to start the day without a cup of coffee.

Even with all the health benefits, is early morning really the best time to consume coffee? According to Steven Miller, a neurologist from Dartmouth, it isn't the wisest thing to do, because our circadian rhythm is the one that determines the best time to consume coffee.

Circadian rhythm is a periodic pattern that takes about 24 hours, where biological functions synchronize with the environmental cues. These basic rhythms are preprogrammed into us genetically. We are meant to be awake, active, and consuming food during the daylight hours or the active phase of the circadian rhythm, and asleep when it is dark. Although we can mess with our cycles through lifestyle habits, the major factor in their regulation is sunlight.

The endogenous mechanisms that regulate the circadian rhythm are organized in a hierarchical manner and consist of the master or central clock, the peripheral clocks and clock genes. The master clock is in the suprachiasmatic nucleus (SCN) in the hypothalamus. The peripheral clocks are in most tissues and organ systems and clock genes are in every cell. One of the many things that circadian rhythm controls in humans is the release of a hormone called cortisol.

COFFEE DOES NOT ADD TO THE SURGE WE WOULD NORMALLY GET FROM CORTISOL;
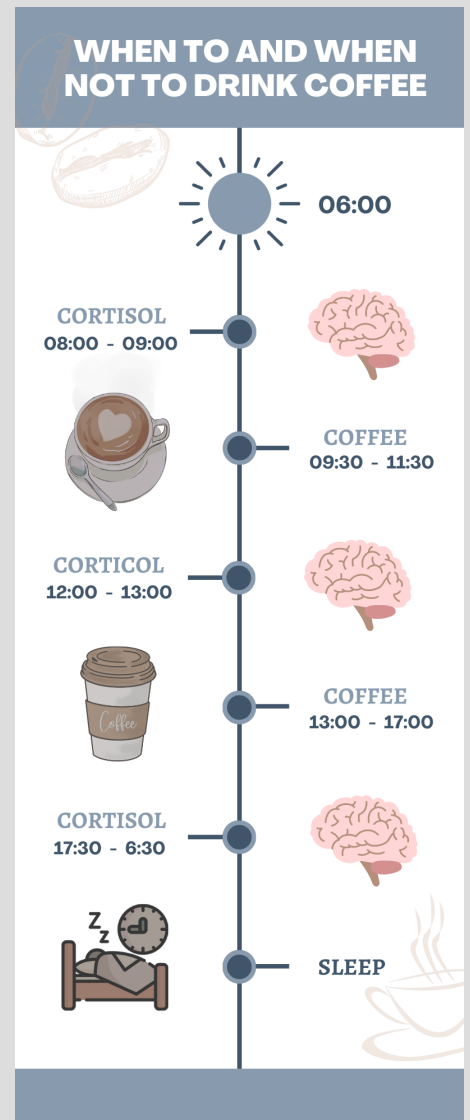
rather, it replaces it.

Cortisol is produced from the adrenal cortex into the circulation following a cascade of signals from the limbic system to hypothalamus and pituitary gland, and levels are maintained within bounds by negative feedback to multiple brain regions. It can serve as a measure of a healthy circadian rhythm. This hormone is produced during times of stress, danger, or anytime you need to be more alert. Cortisol level fluctuates throughout the day. Although the most dramatic peak of cortisol production occurs within an hour of waking up, there are a few other times where concentration of cortisol peaks again. These are between 12:00 to 13:00, and between 17:30 to 18:30.
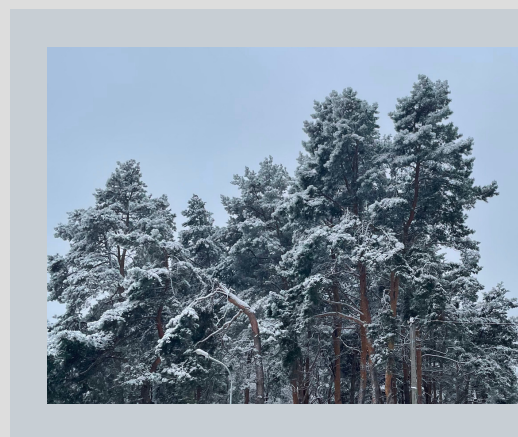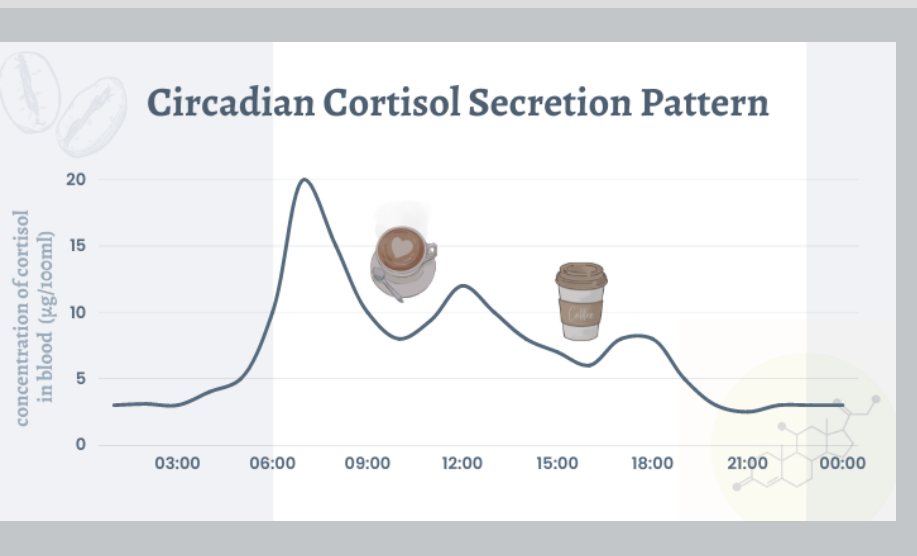
So, if you already have a lot of cortisol running through your system, you don't need caffeine to feel awake. In fact, that feeling of grogginess in the morning is most likely from normal sleep inertia, which is the body's adjustment period between sleeping and wakefulness. And it only typically lasts for 30 minutes to an hour. After that, you can rely on your everyday, regular, and natural dose of cortisol to keep you alert and awake. In other words, coffee is most likely unnecessary at this point in the morning.

The circadian rhythm varies from person to person, and the reaction of the body to coffee also differs in different people. This is why it is hard to say for certain when the best time to drink coffee is. According to a study published in the Journal of Sleep Research carried out by the US army on individuals who wake up at 06:30, morning coffee should be consumed between 8am – 9am. Furthermore, Steven Miller asserts that even if we awaken before sunrise, we will still experience a 50% boost in cortisol production because 'cortisol awakening response' occurs no matter how bright outside is. Hence, early risers can also adjust their first cup of coffee to the blood cortisol level.

According to chrono-pharmacologists who study drug interactions with circadian rhythm, consuming coffee when our body is already at peak cortisol-production, inhibits further production of cortisol and relies more on coffee/caffeine. This can alter the normal functions of the body, as cortisol mediates many metabolic processes ranging from increasing cerebral perfusion, local glucose utilization, enhancing cardiovascular output and modulating immune function. Furthermore, drinking coffee while cortisol is high leads us to develop long-term tolerances for caffeine, which is why so many habitual coffee drinkers say it has less of an effect on them and increase their intake in order to stay alert.

WHEN TO AND WHEN NOT TO DRINK COFFEE

06:00

CORTISOL
08:00 - 09:00

COFFEE
09:30 - 11:30

CORTICOL
12:00 - 13:00

COFFEE
13:00 - 17:00

CORTISOL
17:30 - 6:30

SLEEP

Coffee has become a modern necessity, which we rely on to meet the everyday demands of contemporary capitalism. It's estimated that 1 billion people consume coffee worldwide. If you consider yourself as a procaffeinator or if you frequently increase your daily coffee intake to achieve the desired boost, try switching to drinking coffee after your cortisol levels have decreased.

Circadian Cortisol Secretion Pattern

concentration of cortisol in blood (µg/100ml)

20
15
10
5
0

03:00 06:00 09:00 12:00 15:00 18:00 21:00 00:00

3D BIOPRINTING – FUTURE OF ORGAN TRANSPLANTATION

The highlight of this blog is the advancement of 3D organ bioprinting technology, which has the potential to eliminate the need for organ donors and transplant waiting lists.

WRITTEN BY
ISMAIL ARIF A.
CLASS OF 2023

STANDARD KIDNEY TRANSPLANT ON AVERAGE COSTS **$300,000** WHILE A 3D BIOPRINTER AND THE MATERIAL TO PRINT 3D ORGANS CAN COST AS LITTLE AS **$10,000**.

Organ transplantation is a life-changing event for a person in need. With the proceeding enhancements in modern medical technology, this essential procedure may suffice even without a human donor. 3D bioprinting is the use of biomaterials called bioinks to create three-dimensional structures that are capable of imitating normal functional tissues.

First ever bioprinting was attempted by Robert J. Klebe in 1988 when he used a Hewlett-Packard (HP) inkjet printer to print cells. Since then, bioprinting has gone through multiple developmental stages coming up with new methods, techniques and technologies.

It all begins with the extraction of cells from patient's body using minimally invasive small needle biopsy technique. After that, collected cells are grown in media inside an incubator. These incubators provide correct temperature and oxygenation for optimal growth of cells. The incubation period varies and mainly depends on the size of organ or tissue planned for printing. Next, bioink is created by mixing grown cells and its media with growth factors and hydrogels that ensures continued proliferation and differentiation of cells. Finally, this bioink is loaded into printing cartridges and printing process is started according to preprogrammed 3D image of organ prepared with patients imaging data from scans or X-rays. Printing process takes several hours and it is followed by putting printed tissue or organ in a bioreactor to allow for further maturation of cells before it is ready for transplantation.
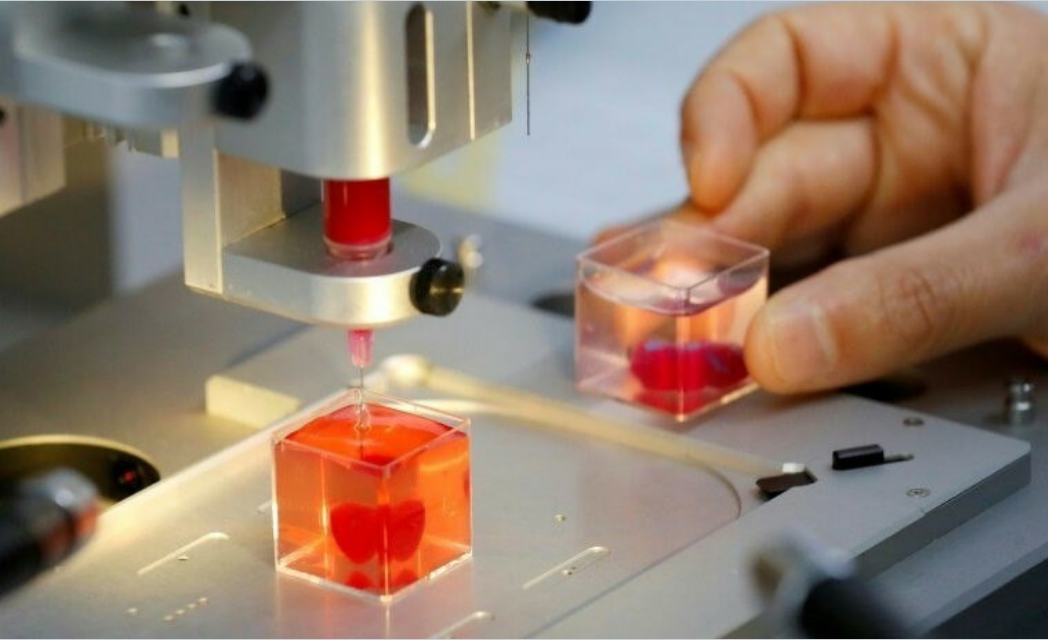
3D print of a heart about the size of a cherry, immersed in liquid, at Tel Aviv University
Photo: *Medical Xpress by Science X Network*

First ever full organ printing and transplantation was performed in 2004 when Luke Massella received a bladder which was printed in the laboratory of Boston Children's Hospital, Massachusetts, USA. For Luke, who was 10 years old at that time, the whole process starting from biopsy to transplantation took just 2 months and his bladder did not have any complications from the transplantation since.

Using bioprinted autogenic organs instead of receiving organs from a donor will definitely be preferable as it comes with reduced complications since patients own cells are being cultivated and are less likely to have severe immune reactions against transplanted tissues. Patients who are getting organs from donors normally should have to be put on post-transplant immunosuppression therapy for the rest of their life. With 3D bioprinting from own cells, it becomes unnecessary to put patients under high dose immunosuppression therapy.
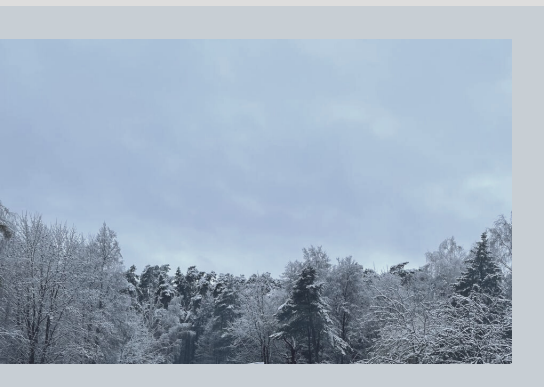
It's no surprise that demand outpaces supply when it comes to organ transplants, causing patients having to waitlist for years to get transplants. It is estimated that 17 people die each day waiting for an organ transplant and a new person is added to the transplant list every 10 minutes. 3D printing could potentially fill this organ deficit as it would only take 2 – 3 months to grow and bioprint instead of waiting for years in the waiting list. It would also be beneficial in situations when surgery is required on healthy donors such as donation of a kidney, as with 3D printing there is no need for a donor at all.

For now, it may seem that 3D printing of organs is more expensive compared to getting a donor organ. However, when we consider all the factors revolving around the transplantation of organs from a donor, starting from the operative cost on donors, pre-operative duration and treatments that patient has to undergo while waiting for transplantation such as dialysis and post-operative regular check-ups, to lifelong immunosuppression therapy that is required, it can be said that 3D printing will be vastly cheaper for the patient on the long run and much less of a burden for the healthcare system. Moreover, costs for bioprinting are estimated to decrease as technology continues to advance.

Recent breakthroughs are promising such as bioprinting of world's first 3D bioprinted heart in 2019 by researchers at Tel Aviv University. This heart was size of a cherry and still requires further improvements to achieve collaborated contractions of cardiomyocytes. Further research and development are still needed before it will become feasible to bioprint whole organs and one of the main challenges which scientists are working on is to find a suitable way to adequately perfuse organs. Proper vasculature structures with small capillaries are important for organs to maintain perfusion and to prevent cell death. Another challenge is the need for precision. Printing organs such as lungs or kidneys would require more precision as they are vastly more complex with more cells per centimeter compared to printing of a bladder.

Even with the tremendous progress that has been achieved, bioprinting of complete organs is yet far from perfect and wouldn't be readily available to the public as soon as we hope it will, but scientists are confident that it would be possible in a decade's time or less. When it does, demand for bioprinting is definitely expected to rise and it would be possible to "order" organs for patients instead of directing them towards a waiting list for organs.
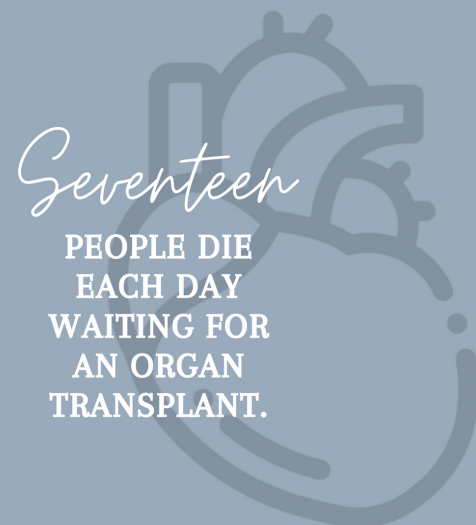
Seventeen

PEOPLE DIE EACH DAY WAITING FOR AN ORGAN TRANSPLANT.